ELECTRONICS Australia

HIFI NEWS

FEBRUARY 1974
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Community radio on Norfolk Island

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Is it really a proposition to have your existing black and white TV set converted to colour? For the answer turn to our story on page 42.

On the cover

Part-time announcer Margaret Fitzsimmons in the tiny studio of station VL2NI, the community radio station on Norfolk Island. Depending heavily on voluntary effort, the station provides both a service for the island's permanent population, and a source of signals to demonstrate radio sets in the duty-free stores!

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Editorial Viewpoint

Chaos and confusion reign . . .

There's no denying that the electronics industry has made an enormous contribution to the development of modern civilisation. By providing the means for virtually instantaneous exchange of information throughout the world, it has enabled mankind to control events and utilise resources with tremendous facility.

In view of this I find it incredibly ironic that in so many ways, the industry has never managed to put its own house in order. One of the outstanding areas in which confustion, complication and inefficiency continue to reign is the type numbering of active devices: valves, diodes, transistors and integrated circuits.

Back in the thirties, when the industry was in its infancy, there were perhaps good excuses for every manufacturer to adopt his own approach to valve types, connections and numbering systems. There were few equipment manufacturers, and they tended to make their own components. But the growth of the industry and the separation of component manufacture from equipment assembly soon drew attention to the difficulties inherent in a laissez-faire approach. It was only by establishing voluntary industry bodies and design registration systems that the valve situation was prevented from becoming complete chaos.

In view of this one would have thought that by the time transistors came along in the late forties, the lessons would have been learnt. But transsistors have been allowed to proliferate in much the same confused and inefficient manner. And if anything, the development of the integrated circuit has been an even sorrier tale.

Certainly, some progress has been made towards standardisation. But much of the apparent progress is illusory. The registration of device designs by industry standards bodies seems often little more than an ad hoc recognition of diversity.

A depressingly vivid example of this is given by the current situation with transistors made in the relatively new TO-92 moulded plastic package. There are at least three distinct and conflicting lead connections for these devices, used by different manufacturers for electrically identical products, and all accepted as "standards. In one case the same type number is used by different manufacturers for devices which although electrically identical have virtually opposite connections!

One hesitates to suggest that there should be Government control of day-to-day industry affairs. But in view of the cost to us all this may ultimately be necessary, unless the industry does a far better job of putting its own house in order.

— Jamieson Rowe

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HIFI HEADPHONES

While Japanese brands tend to dominate the market, there are notable exceptions as, for example, these excellent though rather more expensive Sonab phones.

"If we had been limited to mono, I doubt that many would have got very excited about the new hifi headphones. The sound through them is vastly improved, to be sure, but it lacks the diversity which the same sound tends to acquire when radiated into a normal semi-live listening room.

"But stereo! What a fantastic effect it is the first time one hears high quality stereo on headphones. One is completely surrounded by sound and only slight pressure of the phones against the ears is there to remind one that the whole room is not, in fact, filled with it!"

That's all history now, of course, and during the following decade, headphones grew steadily in popularity.

Then, a couple of years ago, there was a virtual explosion in the market, particularly in and from Japan. This has spread around the hifi-conscious world and now, as we said earlier, it is not uncommon to be faced with ten or a dozen different brands on a hifi counter.

Virtually all new amplifiers have phone facilities built in and even cassette decks which lack loudspeaker facilities do have phone jacks fitted. And the ubiquitous portable cassette player, which has thus far been a strictly mono device, is appearing with replay facilities for personal stereo listening.

The basic reason for the popularity of headphones is undoubtedly the facility they provide to enjoy music of any kind at any time, without disturbing other people. Children can sleep, and other members of the family can read or watch television without a conflict of interest. There is no need for neighbours to share in an unwanted symphony concert or an organ recital!

No less to the point, teenagers can dig and groove to their hearts' content without incurring parental wrath. Among the presents in Santa's most recent deliveries were more than a few pairs of stereo headphones — the price of peace!

Since the 1960 era, headphones have gone through a fair amount of evolution in the search for market acceptance.

As with loudspeakers, most headphones designed for the high fidelity market have used the moving coil principle. A tiny coil, cemented to a cone or diaphragm, is supported in a magnetic field provided by a small magnet structure. When signal current is passed through the coil, it tends to move into or out of the magnet structure, vibrating the diaphragm and creating sound waves. Since the diaphragm and coil can be made of materials not naturally attracted by the magnetic field, they do not have to withstand any initial stress and it is much easier to minimise resonance effects and achieve a wider, smoother response, along with lower distortion.

But while most designers opted, quite early, for the moving coil principle, there was a wide divergence opinion as to the optimum shape and fit of the phones as a whole.

The AKG phones, which we mentioned earlier, were very light, but they simply rested against the ears without enclosing them. The sound was clean but we did remark at the time that bass response was improved markedly by pressing the phones against the ears to provide an airtight seal.

No longer current, these phones fed sound to the ears via tubes, rather like a stethescope. Passenger headphones in overseas aircraft use a similar idea, with transducers in the seat arm.

And herein lies a basic problem with all headphones, and one which does involve the user:

Middle and high frequencies are projected from diaphragm to eardrum with very little loss but lower frequency signals tend to "pump" air in and out between the phone and the wearer's head, without fully activating the eardrum. As far as the listener is concerned, there is a progressive loss of response at the low frequencies which, in the case of the early AKG phones, could be corrected by pushing them hard against the ears.

At the time, we were prepared to accept some loss of bass because of the relative novelty of the listening situation and the very light nature of the phones. But, by and large, the market has rejected this compromise and demands that the bass be preserved by one means or another.

An alternative approach, which was adopted by some manufacturers, was to style the phones in such a way that sound was conducted right into the ear canal by a plug, as in a hearing aid or a doctor's stethoscope. Acoustically, the method can be very effective but listeners have tended to react against it. There is also the matter of hygiene to be considered where the phones are to be used by more than one person.

The trend which has taken over from these and other approaches is to house what are, in effect, miniature loudspeakers in generously proportioned plastic shells, faced with a very soft padding which seals the space between the phone assembly and the wearer's head.

The complete seal largely obviates loss of low frequency energy and ensures sustained bass response. The shape and surface characteristic of the enclosed space is significant, however, in that it can produce cavity resonance effects if not carefully engineered. Such effects are betrayed by a hollow or "boxy" sound in the lower middle register.

A possible problem with phones sealed against the head is perspiration and the discomfort which can arise from two unnaturally hot ears! After all, not too many people choose to wear Balaclava caps in Australia on a hot day or a humid evening.

Back in January '61 we expressed some doubt about headphones of this type, for this very reason, but the simple fact is that they are the ones that are currently dominating the market. Maybe they are what people really prefer but, on the other hand, hot ears may be less of a problem in the market areas which tend to dictate hifi fashions.

Be that as it may, it is a point to consider. A pair of phones which feels comfortable for thirty seconds in an air-conditioned shop may feel quite different after an hour in a humid listening room!

Some designers have reduced the enclosed area and made the phones somewhat less ponderous by facing the earpieces with a special acoustically transparent foam which rests against, and conforms to, the ears rather than the head. Some listeners prefer the approach, others are not so sure.

Largely, it is a matter of personal preference.

The seal between phone and ear is important in another respect — namely the degree to which it can isolate the listener from the environment, and vice versa. Also significant is the housing behind the diaphragm and the nature of any vents

HIFI HEADPHONES

These Goldring phones have separate volume and tone controls in a light housing which normally clips to a shirt pocket or the neck of a dress.

provided in it.

If the sound insulation around the ears and through the housing is minimal, music will radiate into the room and may disturb other occupants who want quiet for sleep or study.

Conversely, if the other occupants want to watch television, or make a noise of some kind, the noise will penetrate and spoil the music.

When choosing phones, it is wise to look ahead, therefore, and try to anticipate such situations. If insulation against sound in or out is likely to be critical, some effort should be made to assess it in the shop by noting which of the available headphones seems best able to exclude outside noise. If the most promising headphones also happen to be the most cumbersome, this factor must be considered.

How cumbersome, and how heavy can headphones afford to be?

In fact, it may be true to suggest that all headphones tend to be heavy, cumbersome, inconvenient, and hot; this in the sense that most people would prefer not to have to wear them at all! But, given that there are cogent reasons for so doing, we can get back to the question:

When one dons a pair of headphones in a hifi shop, one tends to feel as conspicuous as a spaceman. But, apart from that, few if any phones are likely to feel unduly heavy or uncomfortable within the first few minutes. An hour later, the verdict might be different, except that one doesn't expect to be standing around the shop all that time!

The best one can do in many cases is to eliminate those phones which are obviously too cheap, or too expensive, or unsuitable for other reasons. Then concentrate on the "possibles" and try to be ultra-sensitive to their feel. Do they rest comfortably on the head, neither too tight nor too loose? Can the headband be adjusted to suit those who may want to wear them?

If your dealer will let you listen to a few tracks, while he serves someone else, you may be able to confirm your initial judgment.

One other point: reaction to the weight and comfort of headphones is a highly individual matter and the choice is particularly critical for people who may be subject to rheumatic or arthritic effects in neck and shoulders.

So much for the physical aspect; what about the performance?

During the past two or three years, headphones have passed through much the same stage as did pickup cartridges, in that market competition has eliminated most of those types which performed badly, or were non-competitive, or unsatisfactory for other reasons. The bulk of those which are currently being offered on the market conform to a common basic pattern and simply vary in quality and price level.

The cheapest have been selling recently in discount stores for less than $3 per pair. Inside each housing one would expect to find an inexpensive loudspeaker somewhat similar to those fitted to pocket transistor radios. They sound better in headphones, however, because they are normally fed with a higher quality signal, and are better able to propagate a reasonable bass content.

In fact, a pair of $3 headphones we listened to sounded quite pleasant, and far better than the old-time metal diaphragm types. For "medium-fi" listening, they represented excellent value.

From there up, extra dollars can be expected to buy progressively better driver units: smoother response, better bass, more extended treble. Quite a few phones have been on sale for around $12-$15 but the majority of the well regarded types seem to fall in the price range $20-$30.

There are more expensive types, of course, and the listener has to decide whether, for him, the extra outlay is worthwhile.

Why the "for him"?

One of the features which extra dollars may buy is sustained performance up

A complete departure from the dynamic principle, these Stax headphones are of the electrostatic type and require an adaptor to suit them to ordinary amplifiers. They are expensive but good.

Hear. Here.

The incomparable BSR TD8S 8-track stereo tape cartridge player.

This superb machine literally speaks for itself. This cunningly designed and engineered unit produces an extremely high quality stereo sound reproduction from an eight track cartridge. One cartridge will provide four separate stereo programmes of up to one hour and twenty minutes in length. The machine will then repeat the programme indefinitely. Track switching is completely automatic or can be selected by a simple push button selector. Each track is indicated as it is being played.
An integral solid state 3-stage pre-amplifier gives a fully corrected frequency response ideal for feeding into the auxiliary input on a suitable power amplifier. Motor temperature is controlled by an integral force-ventilation system.
The heart of the machine is a four pole dynamically balanced synchronous motor which delivers an unwavering constancy of speed independent of normal voltage fluctuations.
The TD8S is undoubtedly the highest quality 8 track cartridge player available. But why not hear the superior sound of this brilliant machine for yourself at your nearest retailer of sound equipment, because as we said before, the TD8S literally speaks for itself.

Technical Data
Number of tracks: 8 (4 stereo channels); Tape Speed: 3¾ in. per sec. (9.6 cm/sec); Programme Selector: Automatic and manual; Tape Head: Nortronics 4 track with hyperbolic face; Pre-amp Output: 3 stage 750 mv (nominal) 1 Kc Standard Reference Level Tape; Track Playback Sequence: 1 and 5, 2 and 6, 3 and 7, 4 and 8 and infinite repeat; Wow/Flutter: Less than 0.3% total; Frequency Response: Better than 50–10,000 Hz; Power Supply: 210–250 volts, 50 Cycle AC; Dimensions: Cabinet: 261 mm x 206 mm x 99 mm; Net Weight: 5¾ lbs.; Cartridge Dimensions: This unit will accept standard 8 track cartridges measuring 139 mm x 101 mm x 22.5 mm.

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HIFI HEADPHONES

towards 20kHz. To a person of middle age, with a hearing limit of 10kHz, the extra octave would be quite inaudible! Because headphones are more personal and private than loudspeakers it is more relevant to consider who is going to use them.

That observation aside, judgment on the performance of headphones can be along similar lines to what one would exercise-in choosing loudspeakers. Listen to a full orchestra and to a large pipe organ, if your interests lie in that direction. Don't be over-influenced by gimmicky percussion, which tends to sound impressive on even poor quality reproducers. And don't listen to electronic instruments which are delivering their sound through loudspeakers and amplifiers of unknown quality.

Is orchestral sound clean and open? Is there any trace of "boxiness"? Can you hear the "bite" and the slight natural edge to the string tone? Is the bass full and round, or just a series of "tubby" noises? Can you still hear the treble clearly in the presence of heavy bass?

This adapator, described in our August 1973 issue, is intended for use with amplifiers which do not have an in-built headphone jack.

While headphone listening is a different kind of experience, the sound quality should not suffer by comparison with loudspeakers. Top quality headphones should stand comparison with top quality loudspeakers.

What about in-built volume controls?

They are not usually essential but they do have their uses. While volume, balance and tone can be controlled from the main amplifier, it can be something of a nuisance if the controls have to be specially set up to suit, say, a person with a serious hearing imbalance between their respective ears.

There is some advantage in being able to operate the amplifier with control settings normalised for loudspeakers, and to make individual adjustment to the phones without getting out of the chair.

Again, some cassette playing decks are now appearing on the market with headphone facilities but with no means of varying headphone volume. In such circumstances, a control on the phones is obviously worthwhile.

It would appear that most of the headphones now being offered for sale have a nominal impedance of 8 ohms. This is probably an extension of the current 8-ohm loudspeaker "standard" but it does not mean that the phones can simply be substituted directly for loudspeakers.

They could all too easily be damaged by excessive power, to say nothing of the trauma for the listener if his ears were suddenly subjected to an excessive level of sound.

Not to be outdone by AKG Sennheiser also display their wares on a model. Sennheiser phones are highly regarded.

Even if all care were taken with the amplifier volume control, the high effective sensitivity of headphones would tend to make slight residual noise and hum unduly obvious.

Most common practice, nowadays, is to feed the headphone jack from the loudspeaker voice coil circuit through a suitably chosen series resistor. It is usually possible to find a value which will suit 8-ohm phones, yet be reasonable also for phones of a much higher impedance.

(For those with an amplifier having no headphone outlet, a headphone adaptor unit was described in "Electronics Australia" for August 1973).

(Continued on Page 109)

YOU'RE LIVING IN THE HI-FI YEAR 20 A.S.

This is the Hi-Fi Year 20 A.S. *Twenty years AFTER SANSUI. Twenty years* after Sansui successfully introduced a hi-fi amplifier to the world markets. *Twenty years* of Sansui achievement. *Twenty years* of dramatic changes on the hi-fi scene. We've seen the introduction of the stereo recording . . . *and four channel equipment* . . . and Sansui has been there, pioneering research and development for the ever growing international audio market.

Today Sansui equipment leads the field, at home in Japan and overseas. Sansui's formidable reputation has been built around the performance and reliability of the Sansui product. With Japan's most dedicated electronic engineers at the drawing boards *and* supervising production, it's not surprising.

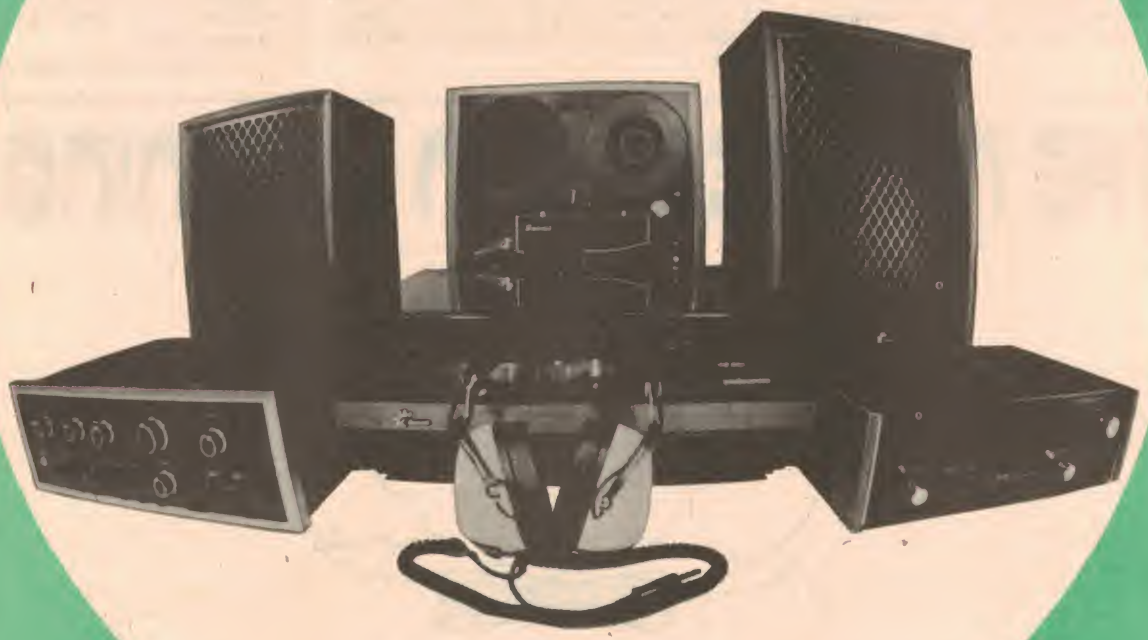
Sansui

Sansui sets world wide standards for audio equipment. You're always ahead technically when you buy Sansui. And you get extraordinary value for money. *See your Bleakley Gray dealer!*

What's in the Sansui range in the Hi-Fi Year 20 A.S.?

☐ **STEREO AMPLIFIERS** ☐ **FOUR CHANNEL AMPLIFIERS AND RECEIVERS**
☐ **FOUR CHANNEL "ADD ON" UNITS**
☐ **STEREO TUNER/RECEIVERS**
☐ **SPEAKER SYSTEMS** ☐ **TUNERS**
☐ **HEADPHONES** ☐ **TWO AND FOUR CHANNEL TAPE DECKS**
☐ **STEREO CASSETTE DECKS**
☐ **TURNTABLES/SOUND SOURCES**
☐ **MANY AUDIO ACCESSORIES.**

Sansui equipment is distributed throughout Australia by the Bleakley Gray Corporation Pty. Limited, a Division of Rank Industries Australia Pty. Limited. Sales and service facilities are nation wide . . . and Sansui performance is matched only by the enthusiasm of the specialist hi-fi stores . . . *the men who sell Sansui.*



Sansui equipment is manufactured by:— Sansui Electric Co. Ltd., 14-1, 2-chome, Izumi, Suginami-Ku, Tokyo, Japan.

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Letters to the editor

The views expressed by correspondents are their own and are not necessarily endorsed by the editorial staff of "Electronics Australia". The Editor reserves the right to select letters on the basis of their potential interest to readers and to abbreviate their contents where this appears to be appropriate.

More on sound modules

It is my belief that you have a greater responsibility to your readers than is expressed in your comment to the letter by A. Rievwers on the Philips "sound module" loudspeakers, published in the December 1973 issue.

Many readers may have felt ill-equipped to understand the "explanation" offered by Mr Rievwers, which could certainly bear considerable elaboration. I was particularly taken by his clincher ". . . and decompose on the surface of the panel."

I personally found the explanation quite meaningless. As far as I am concerned, the speaker in question inherits all the shortcomings of a polystyrene foam diaphragm on an inadequate flat baffle. Furthermore, being a dipole radiator, it should not be placed near a wall as this will hasten the low frequency cutoff due to cancellation.

M. C. McLeod (Malvern, S.A.)

COMMENT: Our original review of the product concerned was presented as an honest and factual one. In all fairness we had to allow the manufacturer to comment, just as we have also published your comments. That's the whole idea behind this section of the magazine — to allow the expression of various points of view, in areas of contention.

Safety checker critic

In your December, 1973 issue a letter from Mr Coward of the Kilkenny Technical College (SA) described a "Safety Checker" for testing portable electric tools and flexible extension cords.

As an engineer employed by a large NSW electricity distribution body, I have had occasion to attempt to develop a "safety checker" on similar lines. Units of a similar nature have been developed by S.E.C.V., E.T.S.A. and others.

It is easy to develop a unit which checks insulation resistance, core continuity, and which checks whether an extension cord is correctly wired.

The problem with these units lies in effecting a satisfactory earth core test. A large current is required to "blow" more than a few strands of .0076 inch wire (e.g., 1 strand — 24A for approx 1 sec; 3 strands — 56A (rising) at 1 sec; 4 strands — 72A for 2 sec; 5 strands — 72A for 5 sec. Rough extrapolation suggests that 10 strands would require at least 150A for 10 sec.)

The unit described by Mr Coward is in my opinion quite inadequate to prove safety of the earth core.

In any case, what is the criterion for a "safe" earth core? Out of 40 or 23 x .0076 strands, is 20 unbroken acceptable? or 15? or 5? If the acceptable number is at all close to the maximum possible, a heavy current withstand test runs the risk of blowing a satisfactory earth core, or damaging the insulation.

A further problem with this type of test is that the unit must be able to cope with cores ranging from a short length of 23/.0076 to (say) 40 metres of 40/.0076. This necessitates a heavy and expensive loading transformer with a large range of taps. It must further have heavy gauge windings to overcome current drift during tests and to provide reasonable repeatability of tests when in frequent use.

Yet another problem is that incipient faults due to loose terminal connections are not detected.

Our initial objective of developing a unit suitable for operation by unskilled personnel was soon abandoned as the numbers of switches, selectors, and length of operating instructions increased.

Our final solution was and is to continue with dismantling, visual examinations and megger checks by trained personnel as the only effective and certain safety check.

J. Purnell (Rockdale, NSW.)

TO-92 connections

Your published note regarding the reversed connections on the TO-92 transistor type PN4250 compared with the 2N4250 helped me solve the problems I had encountred with my Playmaster 136 amplifier, as the TO-92 device had been supplied in the kit without warning about the reversed connections. Thank you.

The question is, whom do I blame for the failure to warn me of the change and its implications? The device manufacturer, who supplied the set of semiconductors, or the kitset supplier, who presumably didn't check that their kits would work as supplied?

F. Bolas (Parkes, NSW)

COMMENT: Perhaps the blame should be divided between both, not necessarily in equal proportions. The connections used by the various manufacturers for their new TO-92 devices differ widely, there being at least three accepted industry "standards". We don't blame you for being annoyed. (See this month's editorial.)

Back in the twenties

In editorial matter concerning the origin of your publication published over the last few years I have seen no mention of the days when I became a regular reader. This was around 1922, perhaps even 1921, when Wireless Weekly appeared as a single folded sheet of glazed paper price twopence. I remember that every week the front page featured a roster of the amateur transmitters for each night of the following week.

Let me mention another gap. No one has mentioned the "Perikon" detector, which

LETTERS

continued to be used into the valve era. I believe this would be the link between the early crystal detectors and modern solid state diodes.

Mr L. Cohen (North Bondi, NSW.)

COMMENT: Many thanks for the reminiscences. We have bound copies of Wireless Weekly extending back to 1928. but you have the advantage over virtually all of us when it comes to the period before that. We hope you still find the magazine of interest.

Amplifier power rating

I would like to take issue with you concerning your "Playmaster 132" amplifier. I put it to you that this amplifier design uses a totally inadequate power supply, which in fact would limit the amplifier output to around 25 watts per channel if it is lucky; certainly less than the quoted figure of 40 to 45 watts.

Since the current in a class B amplifier is ½ the sine wave pulse per audio cycle, the average current per channel is found by the following integration:

$$Iav = \frac{Ip}{2\pi} \int_0^{\pi} \sin\ \omega t\ d(\omega t)$$

which reduces to Iav = Ip / pi, where Ip is the peak load current.

Now using the conservative figure of 40W per channel, and as Ip is given by 2Po / RL, Ip must equal 2 x 40 divided by 8, or 10 amps. Hence Iav must be 3.1 amps, which grossly overloads your power supply.

I would be interested to know how you calculated your power output figures. If you used "peak", IHF, music or any other of these other ridiculous units you must be grouped with those people who fiddle specifications for their own ends.

Of course, you won't print this letter!

N. Hodgson (Frankston, Vic.)

COMMENT: Unfortunately your reasoning has one basic flaw: the peak current is not given by 2Po / RL, but by the square root of this expression. The actual value for peak current is thus 3.16A for one channel, or 6.32A for both channels. This gives an average current of 2A for both channels, within the capacity of the supply. As it happens we measured the power output of the actual amplifier, rather than calculate it from theory.

Your dismissal of all amplifier power ratings other than continuous effective or "RMS" is not really in accord with the facts, as some other ratings do have validity in specific circumstances. Your final comment also appears to be in error.

Importing colour TVs

I have been interested to read in recent articles and departments in your magazine some comments on the proposed colour television service and mention of the possibility of using imported (European) sets in Australia when full colour transmissions begin.

In your "Information Centre" feature in November and also December you state that you do not advise anyone to buy an overseas colour set for use in Australia. Recently, during a period spend in the UK I investigated this possibility and would like to offer the following observations which

you might find interesting:

(1) TRANSMISSION STANDARD: The television standard most closely akin to ours (present and proposed colour) is the CCIR System B used in the majority of Western European countries (Germany, the Netherlands, the Scandinavian countries, etc). The system in use in the UK and Eire is also PAL colour but has a wider video bandwidth and an intercarrier sound spacing of 6.0 MHz instead of the 5.5 MHz used in System B.

(2) CHANNEL FREQUENCIES: Comparison of published figures for the System B channels and Australian standards shows the following relationship. Australian channels 6, 7, 8 & 9 can be received on the same frequencies as channels E5, E6, E7 & E8. Australian channels 10 & 11 and channels E10 & E11 are separated by only 1 MHz and it should be possible to tune these channels on almost all sets by use of the fine tuning control. Aust. channels 0, 1 & 2 and E2, E3 & E4 are separated by 2 MHz and in some sets it would be possible to tune the Australian channels by adjustment of the fine tuning. Channels 3, 4, 5 & 5A in Australia have no equivalent in the European frequency allocation.

Thus a System B set purchased in western Europe might be satisfactory for use in the major state capitals of Australia, but not where channels 3, 4, 5 and 5A are in use.

(3) USE OF "UP CONVERTORS": In Britain the 625 line service is UHF only, but in certain, instances such as communal antenna systems VHF is used to distribute television signals. In order that a commercial single standard UHF set can be used, several manufacturers produce an up-convertor which translates VHF signals to the UHF frequency bands.

When used with a set incorporating a UHF tuner, all of which can be continuously tuned over the UHF band, it becomes possible to receive all Australian VHF channels including channels 3, 4, 5 & 5A. As the convertors are designed for use on the 75 ohm coaxial aerial feeds in use in Britain it will be necessary to buy balun(s) if an aerial using the common 300 ohm twin balanced feeder is to be used in Australia.

As an alternative to modifying the tuner of a European set, I would suggest the purchase of a System B set with UHF tuner and such an up convertor to enable operation without modification in Australia. If operation prior to departure in Britain is desired, the sound intercarrier tuning would need to be altered to 6.0 MHz or a separate sound only tuner purchased. Alternatively a System I (British) set could be purchased, but would need modification.

Anyone contemplating buying a non-Australian set should of course consider the question of availability of spare parts and service, and liability to Customs duty. At present I believe that a set owned and used for 12 months is entitled to duty free admission as a household article. If one is in the category allowing duty free admission of the television set to Australia (as the majority of migrants might be) I do think that this approach should be considered.

P. G. Darling (Epping, NSW.)

COMMENT: Thank you for the information, which will no doubt be of value to those with the necessary background. Our main concern continues to be for the less technical traveller or migrant, however, who is still likely to find the situation rather confusing. And with so many possibilities, the likelihood of their ending up with costly problems is quite high.

(Continued on page 113)

News Highlights

'Hands free' data encoding system

A Voice Data Encoding System (VDES) for hands-free source data entry of quality control measurements has been installed at the Owens-Illinois television picture tube plant, Pittston, Pennsylvania.

Designed and installed by Threshold Technology Incorporated, the new system enables inspection data to be entered verbally as the measurements are being made, thus eliminating the need for manual transcription or keying operations. Furthermore, the system improves both the accuracy of data input and the report preparation, and results in significant cost savings to Owens-Illinois.

In the Owens-Illinois system, the quality control inspector enters, by voice, the physical measurements of the television faceplate he is inspecting, leaving both hands free to position the item for measurement. The verbally entered data is automatically recognised by the VDES and visually displayed for verification by the inspector, so that any mistakes made are immediately corrected.

Threshold Technology's VIP-100 Word Recognition System, the heart of the operation, accepts spoken commands via a small microphone worn by the inspector. An incoming voice entry is analysed and compared to a set of reference samples previously provided for each vocabulary word by the operator during his initial training period. Training data for multiple operators can also be stored in the system, enabling the VIP-100 to recognise spoken words from a wide range of speakers, regardless of vocabularies, dialects and noisy backgrounds.

The main benefits derived from the Voice Data Encoding System are as follows:

- lower production costs;
- reduced manpower requirements;
- system may be expanded as required;
- has remote control facilities;
- the system has verification-correction capabilities;
- has the ability to accept off-line telephone input;
- essential data for management is more readily available.

In a typical day of operation the quality control inspector starts by entering the heading which contains such information as the item type, date, shift, time, name of inspector, and any other pertinent information. The information entered is printed out as the heading on the report generated at the conclusion of a series of measurements.

The inspector then begins calling off measurement data to the VDES. Each measurement is displayed for verification by the operator. As measurements are entered the inspector verifies them on the display and speaks the control word "go," which inputs the data to the VDES for computation and printout.

Any incorrect data can be erased simply by saying "erase." At each step in the process the system displays the measurement to be made, the sample number of the item being measured and the standard value of the measurement. The operator is also alerted, by the display, of any out-of-tolerance measurements.

A summary report of the inspection results, including a detailed listing of out-of-tolerance measurements is automatically printed out at the conclusion of a series of tests.

According to J. Michael Mye, Vice President of Threshold Technology, the VDES hands-free source Data Collection System provides industry with an economical, error-free method of collecting inspection, production and other data in either an on-line or off-line mode of operation, with an increase in efficiency and accuracy.

— George E. Toles

Money identifier for the blind

The cliche "money talks" will soon acquire a new literal meaning for blind business persons thanks to a simple paper money identifier. Developed from NASA technology, the new device will enable a blind person to identify paper money by its sound "signature."

To determine its denomination, a note is passed under a light source on the small, inexpensive device. A phototransistor measures changes in the light patterns produced by the note. These changes are converted into sound signals by an oscillator which produces sounds similar to the "beeping" tones one hears when making a long-distance telephone call. Since the design of various denominations of paper money differs, each bill gives off its own easily identifiable sounds.

The "talking money" concept was developed by NASA's Bio-medical Applications Team at the Southwest Research Institute, San Antonio, Texas. It stems from technology, first reported in 1969 by NASA, for the semi-automatic inspection of microfilm records.

The paper money identifier is being produced by the Marchak Engineering and Manufacturing Company, Austin, Texas. It is being marketed by Applied Rehabilitation Systems, 3902 Idlewild, Austin and is available to training centres and schools for the blind, as well as to individuals.

NASA launches steerable spacecraft

NASA recently launched a manoeuvrable unmanned spacecraft which is linked through a sophisticated ground computer to scientists in widely scattered areas of the US to enable a global study of the Earth's outer atmosphere. The spacecraft, "Atmosphere Explorer C (AE-C)", was launched atop a Delta rocket from the Western Test Range, Lompoc, California, in mid-December last year.

The purpose of this mission, and two subsequent missions in 1975, is to explore in detail an area from 120 to 300 kilometres in altitude where important energy transfer, atomic, and molecular processes occur. These processes are critical to the heat balance of the atmosphere.

Up until now, this area has been probed for only a few minutes at a time by sounding rockets, and only at widely separated points, mostly in the Western Hemisphere. An extensive world-wide investigation of this region will have a significant impact on the scientific community's efforts to construct complete models of Earth's outer environment, and will also add to our understanding of the complex energy-conversion processes which control this environment.

The main energy input to the atmosphere is know to come from the absorption of solar ultraviolet radiation, and a substantial portion comes from the solar wind (a mass of ionized gas flowing out of the Sun) interacting with the atmosphere in the polar regions. An immediate consequence of this interaction can be seen in the aurae, whose bands of light consume more energy than is used by the entire United States. The magnitude and variability of this high latitude heat source which, during geomagnetic storms causes worldwide radio blackouts, is poorly understood. An important objective of this mission is to investigate these processes and mechanisms.

The spacecraft will also examine particle fluxes, airglow intensites, plasma densities, and temperatures and magnetic fields at the low altitudes where the energy dissipation occurs. These measurements will be used to assess the heat balance and energy conversion mechanisms, as well as the flow of heat or energy from one hemisphere to the other.

New long-life pacemaker battery

Chemical-powered batteries will be the ultimate answer to long-life heart pacemakers, according to General Electric's (US) vice-president for research and development.

The new sodium-bromide batteries, which are under development at the GE Research and Development Centre are at present being tested in animals by Medical Systems Business Divisions in Milwaukee, Wisconsin.

Laboratory tests to date indicate that the GE sodium-bromide battery will last as long as the ten-year life now predicted for nuclear power sources. However, pacemakers using the new GE battery are expected to be only a fraction of the cost of nuclear powered pacemakers which are currently estimated to cost $US4,800.

No colour TV before 1975

Colour television will not be generally available to Australian viewers before March 1, 1975. This was confirmed in Melbourne today by the Chairman of the Australian Broadcasting Control Board, Mr Myles Wright.

Mr Wright said that the Board felt it necessary to make this statement in the interests of viewers in view of the recent speculation, which has received wide publicity, that colour transmissions might begin in July 1974.

"Test transmissions in colour are already taking place, and many stations will shortly be working in colour within their studios, in order to prove equipment and train staff", Mr Wright said. "However, the Government's decision is that colour transmissions may not officially commence until March 1, 1975, and the Board will of course administer that decision."

According to Mr Wright, the Board will be authorising trade transmissions (ie special transmissions to assist in the installation of colour receivers), and also limited amounts of normal program transmission in colour designed to promote the sale of colour television receivers and ensuring an adequate population of colour television viewers when the service commences. Discussions are continuing with the industry as to the time schedule and other details of any transmissions in colour which are to be made prior to March, 1975.

The Chairman made it clear that no such transmissions would be authorised as early as July 1974. He said that the Board's primary objectives were first, to ensure, as far as possible, that transmission quality was at optimum standard, and, second, to protect viewers. "In order to meet the second objective", he said, "we want to be sure, when test transmissions start, that an adequate variety of sets is available so that the customers may make a proper choice, and also that transmissions have reached a standard of quality which will enable the sets to be properly installed and adjusted."

Plessey radio best of Whitbread race units

An army "walkie-talkie", acting as the fleet radio for the Whitbread round-the-world racing yachts, is achieving remarkable distances for a unit designed primarily for 30 mile range field operations. The 30 Watt Plessey HF PRC-320 transceiver, designed and built to British Army specifications, is mounted in the 59 foot ocean racer, "British Soldier", the British Army's entry.

The Whitbread race, which is open to single hulled ocean racing yachts with a minimum crew of five, began on September 8 from Portsmouth. It is divided into four legs, with stops at Cape Town, Sydney and Rio de Janeiro. The first yachts in the race began to arrive in Sydney on Friday, December 7.

Having earlier proved itself the most efficient radio in the fleet, the PRC-320 is handling messages for other yachts and working back to base in England.

Australian Army Signals officers liaising for the "British Soldier" said communications from the fleet to their stations in Perth and Sydney were poor, because of ionospheric conditions. The "British Soldier" was, they said, working back to British bases for the whole fleet from positions south and south-east of the Australian continent. Members of the British Army Amateur Radio Society are also maintaining contact with the yacht during the race, while additional shore-based communications stations have been established in Australia and the Falkland Islands.

Award for AWA

A replica of the special loudspeaker column designed and made at AWA's North Ryde works for the Sydney Opera House concert hall has won AWA a Gold Medal Diploma at the Milano Triennale. The loudspeaker column is part of the Company's large scale electro-acoustic system which controls various aspects of program reinforcement in the Opera House.

Organised by the Visual Arts Board of the Australian Council for the Arts, Australia's display, its first at the Milan exhibition, featured the Sydney Opera House.

The Gold Medal Diploma was awarded for value of design and manufacture, and was assigned by a jury made up of a committee of foreign exhibitors and a member of the Italian Ministry of Public Instruction.

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NEWS HIGHLIGHTS

India's electronics industry expanding

The electronics industry in India is becoming increasingly important with many locally manufactured electronic items now having a high indigenous content. In addition, an increasing number of Indian designed and manufactured electronic products are now appearing on the market.

Among these new products is a new digital calculator developed by Superior Electronic Systems Limited, Bombay. Designated the Superior 14M, the calculator has a built-in 14-digit memory, and is capable of performing six functions. Seventy per cent of the parts used in the Superior 14M are manufactured locally. The company has been licensed to manufacture 3,000 calculators a year.

In other news, the United Nations Development Program has decided to give India $US8 million to establish three big computer complexes. The first of these will be estabished at the Tata Institute of Fundamental Research, Bombay, whilst the other two complexes will be at the Jawaharlal Nehru University, New Delhi, and the National Aeronautical Laboratory, Bangalore.

India's fifth Five Year Plan, which starts in April, 1974 and is in its final planning stages, envisages a substantial amount of government aid to the electronics industry in both the public and private sector. In particular, aid will be given for the manufacture of computers, radios, TVs, tape recorders, semiconductors, and communications equipment. The government is also planning to establish a plant for making TV picture tubes, and will invest large amounts in integrated circuit technology.

— N. Viswanath, New Delhi

New 400 Watt laser

As a result of its recent acquisition of the industrial CO2 laser line of American Optical Corporation, the Korad Division of Hadron, Incorporated has introduced a new 400-Watt CO2 laser, Model KG45.

Specifically designed to meet the requirements of industry for a reliable, easy-to-operate system, the KG45 provides both continuous and pulsed power outputs of up to 300 Watts at 1kHz. Other features include a unique plasma-discharge initiation concept that ensures trouble-free start-up at all power levels; a choice of hand-held control or automatic, remote control operation; pre-aligned resonator mirrors and continuously flowing gas.

The basic KG45 system comprises the laser head and a power-supply console, which can easily be incorporated into most industrial applications. The laser head

consists of large-diameter water-cooled discharge tubes within an optically folded laser cavity.

Operation of the KG45 in the lowest order modes produces focused power densities many times those obtained by equal power multi-mode lasers. Provision is also made for mounting optical accessories, and the laser head is interlocked to protect operating personnel and the system itself.

Revolutionary hand-held colour TV camera

A revolutionary hand-held colour TV camera, commissioned two years ago by CBS News and developed by Ikegami Tsushinki Company Ltd, Tokyo, is now in operation with the CBS Television Network Engineering and Development Department at the CBS News Los Angeles Bureau. The new camera which weighs only 121 lbs, provides broadcast quality pictures using natural lighting and may be used for live broadcasts or videotape recording.

Incorporated into the new system is a videotape recorder manufactured by International Video Corporation, Sunnyvale, California. This is a small unit using one inch tape and capable of recording up to one hour of material on a simple cartridge. The use of a time base corrector enables the one-inch tape to be made compatible with broadcast standards.

According to Marshall B. Davidson, the Vice President of CBS News, this is the first time that a really small hand-held camera and an equally compact helical scan videotape machine have been used by a television network for news broadcasts. "The potential of this system is limitless",

says Davidson, "and it will be invaluable in covering late breaking news stories by eliminating the time problems encountered in film coverage. Eventually, we plan to use this compact and relatively inexpensive, high quality system in all the CBS News Bureaux".

X-ray examination of airline baggage

A novel form of baggage inspection, installed at London Airport, enables the security authorities to inspect the contents of cases entering the cargo hold of an aircraft without opening the cases or disturbing the contents.

Developed by a British firm, Pantak Limited, the system uses an EMI Electronics Limited low light television camera for remotely examining X-ray images. The X-ray equipment is mounted over a conveyor belt which transports the cases under the X-ray

Below the belt, and directly underneath the X-ray head, is a flourescent screen. When the X-ray machine is switched on, a radiograph of the case and its contents appears on this screen. The image is clearly defined but very faint, and, although it would be possible to view it with the naked eye adapted to darkness, it would entail the viewer sitting in the dark and being directly exposed to the X-rays.

To overcome this, the image is projected via a 45 degree mirror onto the lens of an EMI MTVI low light television camera, which intensifies it 500 times and produces a clear picture on a remote television monitor screen at which an operator is seated.

The initial picture seen on the screen is of the entire case and its contents. If the operator sees something which merits closer inspection he can examine any part of the baggage at up to 5 times magnification.

Fire resistant backs for colour TVs

Demands by consumer associations for greater safety in new television sets are now beginning to be met by set manufacturers who are insisting that their suppliers comply with much stricter product specifications.

In a recent British report on colour televisions several well known sets were not recommended as "good buys" because they did not incorporate flame proof backs. As a direct result of this, and pressure from other safety and standard setting organisations, set makers are switching almost entirely to flame proof backs.

One company who welcomes this move is Fibre Resin Developments Ltd, who for the past year have been trying to persuade set manufacturers to use their latest flame retardant material which meets the relevant British Standard specifications.

Fibre resin mouldings, as Fibre Resin Developments Ltd (FRD) call them, basically consist of cellulose fibres impregnated with phenolic resin. Unlike most plastic processes, two forming stages are used, one when the material is set and one when the material is dry.

The raw cellulosic material is beaten up with water to form a slurry to which phenolic resin, mineral acids and other flame retardant additives are added.

A wet preform resembling the final shape is then made. After drying out in an oven the preform is finally pressed out by steel dies so that the familiar rigid back panels seen on most televisions is formed. If required a final coat of paint is applied after punching ventilation holes.

Offering pipe organ sound with electronic flexibility:

The new breed of Electronic Organs

Ever since electronic organs first appeared, pipe organ enthusiasts have tended to dismiss them as little more than elaborate audio oscillators fitted with keyboards. Perhaps this was justified in the early days, but as this article explains electronic organs have made big strides, and now represent a very serious challenge to pipe organ supremacy.

Until a few months ago, like most pipe organ enthusiasts, I was inclined to believe that electronic organs would never present a serious challenge to the pipe organ. Sure, if they tried hard enough, they could sound quite impressive. But with most that I had heard, there was a certain sameness or sterility about the sound.

One way or another, they just didn't seem to have "life." There wasn't that ability to send shivers up and down one's spine, as a full diapason chorus complete with mutations and mixtures screamed forth a mighty chord, or an ethereal string celeste whispered elusively in the distance. Nor was there that sensuous, warm, giddy feeling evoked by a descending pedal run on a generously scaled 32-foot double open wood . . .

And of course there wasn't the feeling of nostalgia, the feeling that one was listening to thousands of individual pipes each painstakingly made and voiced by skilled craftsmen using techniques handed down since the days of Silbermann and Arp Schnitger. Just a console with a few dull looking loudspeaker cabinets, and the inevitable power cord and plug!

RODGERS' "AMERICAN CLASSIC" organ, similar to that used in the Opera House concert. Features three manuals and pedal, 46 stops.

But now I'm not nearly so sure. The doubts first started to rise when I came across the story we published in our May 1973 issue, on the Allen digital computer organ. It was first drawn to my notice by Ray Mackay, of Doncaster East, Victoria, who is now the Australian agent for Allen. As soon as I saw the article I knew the Allen organ represented a significant development, and it was for this reason that we reprinted the article.

But doubts about pipe organ supremacy really started to gain ground around October last year, when the Sydney Opera House was being opened. Just before the concert given by the Cleveland Symphony Orchestra, I received a 'phone call from Bill Glasson of the Organ Centre, in Caulfield, Victoria, who handles Rodgers organs. Apparently the pipe organ in the Opera House concert hall was not operational, and arrangements had been made for Bill to provide at short notice one of the big Rodgers "American Classic" models, to provide the organ accompaniment. Would we like to come down and hear it?

To cut a long story short, Editor-in-chief Neville Williams and I went down, heard it and were impressed. Even though the organ and two of its big speaker boxes (space prevented them using the full complement) were simply squeezed into available spaces on the stage amid the rest of the orchestra, it gave a very impressive account of itself.

Listening to Bill's chief engineer and demonstrator David Johnston, as he effortlessly played excerpts from each of the various schools — German baroque, English traditional, French romantic, and so on — it was difficult to believe that one wasn't listening to an authentic pipe organ., The pipe speaking transients, the random beats and phase shifts were all there! The purist in me started to wither noticeably..

And if I needed any further convincing, it came a few weeks ago when Ray Mackay wrote giving details of the latest Allen instruments, and sending some LP records demonstrating their capabilities. Along with Neville Williams and Ian Pogson, I took a couple home for review, and as with the Rodgers the effect was dramatic. The similarity to a "real" pipe organ is incredible, and if you don't believe me I suggest that you send to Ray Mackay for one of the discs, and judge for yourself. Details of price and availability are given in the panel.

Fairly obviously, electronic organs have

ALLEN'S SYSTEM 1500 instrument, which offers three manuals and pedal with 57 stops including four alterable voices.

by JAMIESON ROWE

come a long way in a short time, and the top of the line models of brands like Rodgers and Allen are in virtually every way as comprehensive and as musically exciting as the most elaborate pipe organs. At the same time, they are able to offer a standard of reliability which would be very difficult to achieve with a pipe organ.

How has this been done? For the basic details of the Allen computer organ, you'll have to refer back to our May 1973 article. A little bit later on, I'll give some of the further information Ray Mackay has sent on the Allen instruments. But at this stage, it seems appropriate to give some details of the Rodgers organs, as these represent a somewhat different approach to the same problems.

The section which follows is based heavily on notes supplied by Bill Glasson and David Johnston, and for this I'm very grateful.

Apparently the Rodgers Organ Company is a relatively new entry into the organ field, having been formed in 1958 by two engineers from Tektronix. They set up business in Hillsboro, Oregon, carving out a market in large custom and semi-custom instruments. In 1958 they were the first company to produce an all-transistor organ.

The design philosophy Rodgers have adopted could perhaps be best described as the "analog" approach, in contrast with the digital approach used by Allen. In place of a row of pipes, Rodgers have a row of oscillators: one per note, and all individually tunable. The oscillators are all of the L-C type, the coils being contained in tunable potcores.

In the smaller organs, which have two 61-note manuals and a 32-note pedalboard, there are 85 oscillators in the main set with a further 37 off-tuned oscillators for the celeste, if used. In the larger models, such as the "American Classic" used in the Opera House concert, there are three main sets of oscillators and two celeste sets: a total of 399 oscillators. The two celeste sets are tuned sharp and flat respectively.

Each of the oscillators generates a basic waveform, which is modified in the keying and filtering circuits to produce the finally desired waveform.

All of the Rodgers organs use a diode keying system which employs only one contact under each key. In all but the largest models, time multiplexing is used to keep wiring simpler and reduce the number of components required. A clock generator running at around 85kHz drives a ring counter, whose output is used to cyclically scan the various keyboards and the pedalboard. Thus during one clock period the Great manual keys may be scanned, and the selected Great stops gated on to be activated as appropriate; during the next clock period, the Swell manual keys will be scanned, and the stops gated on; and the next clock period the Pedal keys and stops; and so on. Each keyboard is thus synchronised with its own selected stops, and operates independently while using common circuits.

On the larger organs, with more than one set of main oscillators, stops of the same family on one keyboard are taken from different sets of oscillators. For the diapason chorus, for example, the 8ft Principal may be taken from one main oscillator set, the 4ft Octave from another, and the 2ft Doublette from the third. When sounded together as an ensemble, they thus have the warmth and depth produced by subtle phase differences and out-of-tune beats, as with a pipe organ.

A further refinement developed by Rodgers is what they call "natural activity." This is an ingenious system which allows individual pitch sources to interact, causing each oscillator to vary slightly about its pitch centre in a way which closely simulates the effect of wind supply transients upon pipe speech. The additional randomness produced enhances the warmth of ensemble tone considerably. The effect is adjustable, however, and may be disabled if not desired.

Quite distinct from "natural activity" are the various speaking transients which Rodgers provide. All of the flue stops are provided with "air noise," duplicating the sound produced by wind as it passes through the flue of a pipe. Also provided for the flue stops is "edge-tone," which simulates the sound produced as the wind impinges on the upper lip of a flue pipe mouth. Both of these are fully adjustable.

For the flute stops, "chiff" is available. This simulates the starting transient which tends to be characteristic of un-nicked pipes. It is produced by gating a short burst of the note $2^1/_2$ octaves above the actual keyed pitch, known as the "19th." The chiff is fully adjustable, as before, but in this case only sounds when flute stops are keyed.

And as if this were not enough, Rodgers also go to the trouble of simulating the peculiar way in which reed pipes tend to blow sharp before the resonator stabilises the pitch.

The attack and decay characteristics of organ pipes vary both with pitch and with the type of pipe. Reed pipes tend to speak faster than flue pipes, and string and diapason flue pipes tend to speak faster than flute pipes. Similarly treble pipes tend to speak faster than bass pipes, although this varies depending upon the stop. To simulate these effects, Rodgers use as many as 13 separate keying circuits, each handling a specific group of stops or section of the compass.

All of the components in Rodgers organs are discrete, and Rodgers make the point that this makes the instruments easier to service in the field. It also allows them to provide for individual voicing of every note, so that an instrument may be tailored to suit the building in the same way as a pipe organ.

The manual and pedal pistons used to allow rapid selection of stop combinations are fully programmable, and employ a ferrite core memory system. With a large instrument such as the "American Classic," there are in effect four distinct core memories, one for each manual and

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one for the pedal division. The use of a ferrite core memory system means that the combinations are retained indefinitely, even after the power is turned off.

A criticism often levelled at electronic organs is that they do not have the same dynamic range capability as a pipe organ, by virtue of limited power output. As one might expect, Rodgers have paid considerable attention to this aspect. To illustrate their approach, the American Classic used in the Sydney Opera House concert was provided with six channels of amplification, each rated at 100 watts continuous ("RMS"). The output is fed into a variety of loudspeakers, varying from pressure tweeters to heavy-duty 15inch woofers in folded horn enclosures.

The voices on each manual are fed to different tone cabinets, to produce acoustic mixing of the sounds of the major choruses and also spread the sound in space. Thus for the pedal flutes the 16ft Bourdon is fed to one cabinet, the 8ft Bourdon to another cabinet, and the 4ft Nachthorn to a third.

Naturally enough, this thoroughgoing analog approach to electronic organ building tends to make Rodgers organs rather more expensive than more conventional instruments. However they currently make a range of models, working up from the relatively modest "Specification 110". with two manuals and pedal to large three-manual and pedal instruments like the "Specification 990," the "American Classic," and the "Custom Touring Organ." The latter is a lightweight but very comprehensive instrument designed especially for touring concert work. Well-known US organists such as Virgil Fox and Ted Alan Worth have apparently made extensive use of such instruments in recent years.

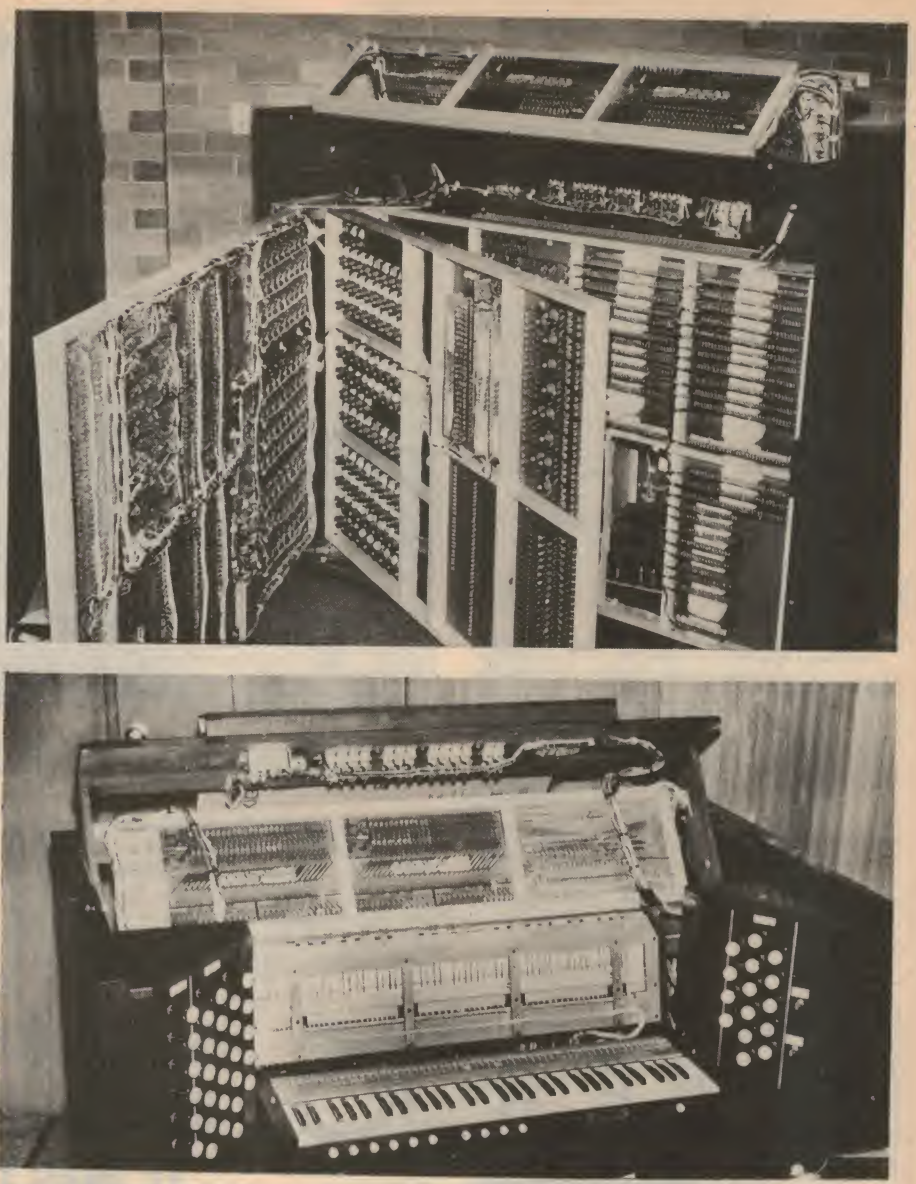
Rodgers also make a number of theatre organ models, all three manual instruments with the traditional "horseshoe array" of stop-tabs. The smallest in the range is the Trio 321, with two sets of oscillators and a unique AM-FM tremulant system in which two unsynchronised modulation signals are applied to the "odd" and "even" note oscillators to simulate the effects of pneumatic delay in a long theatre organ soundboard with the pipes planted "every other note."

The larger theatre organ models in the Rodgers include copies of well-known instruments such as the Wurlitzer Style 260. The organ copied from this particular instrument has no less than 14 complete sets of oscillators, which are housed in a cabinet separate from the console.

Prices for Rodgers organs start at around $3,500 Australian. Those interested in further information regarding the models available, prices, and other details could contact The Organ Centre, 238 Balaclava Road, Caulfield, 3161, or their interstate agents.

Returning now to the Allen computer organs, it seems clear from the further information sent to us by Ray Mackay that these have gained wide acceptance since their introduction in 1971.

In their recent literature Allen very proudly list and describe their latest installations, and these illustrate in no uncertain terms the degree of enthusiasm which the computer organ concept has won for itself. Perhaps the most noteworthy is in Chichester Cathedral, England, where a large three manual Allen instrument has been installed alongside the cathedral's historic pipe organ, to handle the major part of the musical load. With the console located high up on the Bell-Arundel screen in the 800-year-old cathedral, the organ is said to sound most majestic as the result of special efforts made to allow for the 6-second nave reverberation time.



TWO VIEWS of the interior of a Rodgers model 220 instrument. At top is a rear view with the generator panels swung out; above is a front view showing the combination core memory and the top manual swung up for servicing.

Other notable Allen installations are in St Agnes Cathedral, New York; Calvary Baptist Church, New York; Notre Dame Roman Catholic Church, Denver, Colorado; North Street SDA Church, Kingston, Jamaica; the Union Church of San Juan, Puerto Rico; Southlands College, Wimbledon, UK; Sioux Falls College, South Dakota; and the historic Dahlgren Chapel at Georgetown University.

A demonstration of the Allen computer organs was featured by the BBC in their well-known program "Tomorrow's World." Also the organs were named one of the best new products of 1972, by a panel of top inventors and scientists including William Lear and Werhner von Braun. As a result the Allen company received one of the coveted awards made by Industrial Research, Inc, at the annual ceremony in Chicago's Museum of Science and Industry.

The computer organs haven't just impressed the scientists, either. Such well-known US organists as Dr Robert Elmore, William Whitehead and Earl Ness have given them warm endorsement, as also have overseas organists like UK virtuoso Stephen Hicks. And the organs have been featured in numerous concerts by orchestras such as the New York Philharmonic, the Boston Symphony, the Philadelphia Orchestra, and the Los Angeles Philharmonic, and under the batons of Leonard Bernstein, Eugene Ormandy, Leopold Stokowski and Arthur Fiedler.

Like the Rodgers instruments, the Allen organs have very obviously "come of age" in the full musical sense. Bearing this in mind, it is therefore not surprising that from the operational point of view the organs have considerable similarities — despite the marked differences inside.

As with Rodgers, Allen make a fairly large range of instruments, ranging from

the System 100 with two manuals and pedalboard, to large three-manual instruments such as the System 1500 and similar custom organs. All are based on the digital computer principle described in the May 1973 article, wherein the speech characteristics of organ pipes are stored in digital form, and re-created when required.

The digital circuitry is largely in the form of LSI integrated circuits, using MOS technology. All of the pitches are derived from a single 4MHz frequency standard, used to produce four-phase 1MHz clock signals, and the resulting stability is so good that the organs never need retuning.

One of the advantages of the computer organ pitch generation system is that key changes can be made automatically. Hence even the smallest Allen instruments are provided with a "transposer switch," by which the pitch of the entire instrument may be changed up or down from normal by up to seven semi-tones.

Another feature of all but the simplest Allen instruments is the ability to provide "alterable voices." By this means virtually any desired stops may be added to the organ when required, by feeding in the necessary parameters on a punched computer card. The stop or stops concerned are then fed into memory, and made available on special unmarked stop-tabs or drawbars. On the System 102, a two-manual instrument, there are three such Alterable Voice stops, while on the large three-manual custom instruments there are as many as eight.

Along with the Rodgers instruments, the Allen organs incorporate programmable combination pistons (capture combination action). In this case the combinations are stored in the MOS memory, however, and are thus essentially volatile — they have to be set up each time the organ is used. There is a built-in battery supply system to provide against short-term power failures, however.

One might perhaps expect that because all the pitches in an Allen organ are derived from a single 4MHz reference source, its sound would lack the "life" given by random phase differences and out-of-tune

TECHNICIAN completes wiring of a two-manual Allen organ. Because of the digital multiplex technique used, there is very little hard wiring.

beats. However this is not so, as Allen have incorporated a "random motion" effect to introduce deliberate randomness into the pitch generation. In any case the 4MHz clock reference is not simply divided down to produce the various note pitches, but merely determines the rate at which the notes are synthesised by the digital circuitry.

Quite apart from this, Allen also provide controllable chiff and wind noises. And the note synthesising circuits accurately duplicate the speaking characteristics of organ pipes, so that the degree of realism is very high.

On the more advanced models, celeste effect is available on all divisions, including the pedal.

One of the points which Allen stress about their organs is that the digital synthesis technique treats each stop individually, so that there is no "unification," "duplexing," borrowing or extension. This must inevitably help in creating a true ensemble sound, and in giving the instruments the "life" of traditional pipe organs.

Many of the more advanced Allen instruments are available with either contemporary stop-tab consoles, or traditional draw-stop consoles. In all cases the organs have a full AGO specification, with the radiating concave 32-note pedalboard.

Like Rodgers, Allen provide quite elaborate audio power output provisions and loudspeaker systems on the larger models, to give them adequate dynamic range. Thus the System 201 and 301 has two output channels, with a total of 100 watts continuous effective ("RMS"), the System 601 has four channels and 200 watts, the System 900 six channels and 300 watts, the System 1200 eight channels and 400 watts, and the System 1500 ten channels and 500 watts. Custom loudspeaker systems, including systems for "antiphonal" divisions, are available as options.

Prices for the Allen organs range from $5,367 for the System 100 to $19,667 for the System 900, with larger instruments listed as "price on application." Naturally these tend to be subject to variation, depending upon the options required to suit the building.

Enquiries regarding Allen organs should be directed to Mackay Electronic Distributors Pty Ltd, 32 Woodhouse Road, Doncaster East, Victoria 3109.

Reviews of some of the Allen Organ records:

ALLEN DIGITAL COMPUTER ORGAN DEMONSTRATION. Dr Robert Elmore playing the organ at Calvary Baptist Church, New York City. Allen AO-3600A.

This is basically a disc to demonstrate the capabilities of the three-manual and 70 stop "900 series" instrument in the Allen Digital Computer Organ range. The first side has a selection of five short works played by the virtuoso organist Dr Robert Elmore, while the second side has a narrative with illustrative excerpts.

It is a good disc for someone like myself who, until now, has regarded themselves as a pipe-organ purist. If you need convincing that electronic organs have completely outgrown the "audio oscillator with a keyboard" stage, it should certainly provide that.

In my case, I still felt a few reservations after listening to the first side with its well-known pieces by Bach and Durufle. There was still a certain "indefinable something" which seemed to be lacking, compared with a real pipe organ. But when I played into the second side, with its demonstrations of the various voices, ensemble tone, mutations, and so on, it hit me. Listening to an excerpt from a Bach trio sonato (one of my favourites), and another from a Cesar Franck chorale, it just seems incredible that one is not listening to a pipe organ.

Incidentally, those who are familiar with the disc made by G. Donald Harrison some years ago to demonstrate the Aeolian-Skinner "American Classic" organs will be intrigued to note, as I did, that many of the uame little excerpts are used to demonstrate similar stops, etc.

Short of hearing an Allen 900 itself in operation, this would be the next best thing. The recording sounds a little elderly, and it's only mono, but it's an ear-opener nonetheless. If only Arp Schnitger could have lived to see what they would be able to do with a few yards of wire and some grains of sand! (J.R.)

★ ★ ★

THE ALLEN ORGAN, played by Carlo James Curley. Stereo, Allen Organ Company, DLW-1011.

This disc is also designed to demonstrate the capabilities of an Allen Digital Computer organ, in this case one of the simpler "300 Series" instruments having two manuals and pedal, and 40 stops with four alterable voices. The instrument heard is that in the Faith Reform Church in Zeeland, Michigan, and the player is the 19-year-old Carlo James Curley.

The works played are the Concerto No 4 by Bach / Vivaldi, the Chorale Prelude "I Call to Thee, Lord Jesus Christ" by Bach, Suite No 1 by Clerambault, Clair de Lune by Louis Vierne, the "Gigue" fugue by Buxtehude, Pasticcio by Langlais, the antiphon "I am Black but Comely, O Ye Daughters of Jerusalem" by Dupre, and Bach's Trio Sonata No 6.

I find this disc somewhat less satisfying than that demonstrating the 900 series instrument, not so much because the smaller instrument seems less capable of dealing with the works played, but because I feel the organist does not do either organ or works full justice. Apparently consumed with the desire to demonstrate his undoubted ability to co-ordinate his fingers and feet at a prodigious speed, he blithely gallops through the Bach, Buxtehude and Vivaldi works with scarcely time to catch breath.

From what one does hear of the 300 series instrument, it sounds very capable, and far more suitable for serious classical works than most other electronic instruments in the same price bracket. Perhaps the only reservation in this regard might be the pedal section, although its lack of evidence on this disc may again be due to the player.

The recording is a more modern one, and in stereo. The dubbing from the master tape is a little rough in places, and there are rather too many clicks and clunks from the console evident; also the final movement of the Bach Trio Sonata seems to have been severely truncated. But these criticisms aside, it is again a very interesting disc, and one which drives home the outstanding capabilities of the Allen computer organ. (J.R.)

★ ★ ★

CARLO CURLEY CONCERT CURIOS. Stereo, DLW-1010B. Allen Organ Company.

On first listening to even a little of this recording, made to demonstrate the three-manual "900" model, one is quite convinced that the instrument is indeed a pipe organ. Most laymen would be quite content to settle for this initial impression. However, experts may detect some subtle differences when compared with the real thing. I felt that there was a smoothness which is not generally associated with pipe organs. Some may consider this a good thing, while the pundits would perhaps still prefer to hear those instrusions on the music which may be heard when listening to a real pipe organ.

The program is a varied one. Side 1 has Fantasie in E-flat Major by Camille Saint-Saens, Cantabile by Cesar Franck, and Chorale Preludes "Awake Thou Wint'ry Earth" and "Good Christian Men, Rejoice" by J. S. Bach. On side 2 is Marche Militaire by Franz Schubert, Marche Religeuse by Alexandre Guilmant, Melody in A Major by Brig. Gen. Charles Dawes, Sinfonia from Cantata 29: We Thank Thee, God by J. S. Bach and Aria from Tenth Concerto for Strings by George Frederich Handel. These items were recorded at Saint Francis Xavier Roman Catholic Church, Grand Rapids, Michigan.

The diapasons and reeds are most convincing, with the strings being particularly pleasing. The pedal division is excellent, although at times Curley's use of it may be open to debate. Percussion left me with a question mark hanging over my head. Perhaps the designers could do a little more work on this particular section.

The acoustics of the auditorium greatly enhance the sound of an already fine instrument. The reverberation time I estimate to be about four seconds.

Those enthusiasts who may have the money to spend on such an instrument for home use should consider the sobering thought that the lack of such acoustics may lead to considerable disappointment.

Carlo Curley's treatment of Schubert's Marche Militaire and Charles Dawes' Melody in A Major, I found most pleasing. On the other hand, he may cause some purist eyebrows to rise with the way he handles some of the other pieces. Ifeel that J. S. Bach would not approve, for a start.

In addition to the pleasant listening it affords, I can confidently recommend this recording as an example of the impact modern technology is having on the classical organ. If you are a dyed-in-the-wool pipe organ devotee, then this recording is especially for you. (I.L.P.)

★ ★ ★

NOTE: All three of the above records may be obtained from Mackay Electronic Distributors Pty Ltd, 32 Woodhouse Road, Doncaster East" Victoria 3109. The cost of AO-3600A is $3.00, while the other two are $5.00 each. Two further Allen organ records are reviewed in the Variety Fare columns.

Norfolk Island Community Radio

While there is currently a fair amount of discussion about the potential of community radio stations, they are not as remote from the Australian scene as might be assumed. Several such stations are operating on off-shore islands and the one on Norfolk Island is typical.

by NEVILLE WILLIAMS

A tiny volcanic outcrop in the Pacific, about 900 miles ENE of Sydney, Norfolk Island is largely isolated from the media, from either mainland Australia or New Zealand. It is far beyond the reach of television and, during daylight hours, even broadcast band signals get lost en route. Newspapers arrive only when there is space to spare on incoming aircraft.

Against this background of isolation the tiny local radio station provides a welcome sound, with its early morning newscasts from Radio Australia, its local announcements, and its programs of recorded music and talks.

Few local receivers would not be tuned to VL2NI when it opens each weekday morning at 7.15.

As well, its signal serves one other very practical purpose: It makes it possible for the thirty-odd duty-free stores to demonstrate the endless array of Japanese radio sets on their shelves. Without a local signal, there would be nothing to hear on the broadcast band other than a gentle hiss, a few stray crackles of electrical interference and a couple of station carriers so weak as to be barely perceptible.

When it first went into operation in the early 50's, VL2NI Norfolk Island was on the air for only a few minutes each morning with a weather report and movements of aircraft and shipping.

Then someone organised a few minutes of music before and after the voice announcements and the move to make better use of the facility was under way. A local news bulletin was added to the transmission; local clergy took an interest and a daily hospital session emerged, with personal calls and music. More music was added as the record library built up and, nowadays, this is reinforced by program tapes from the Australian Broadcasting Commission, the BBC in Britain, occasional tapes from the American networks, and programs from the Christian Broadcasting Association in Sydney.

At the present time, the station is on the air each weekday from 7.15am to 1.15pm, Saturdays from 11.00am to 7.00pm, and Sundays from 5.00pm to 11.00pm. On Tuesdays there is an evening session from 7.30pm to 10.30pm, usually of a cultural nature.

The Norfolk Island Administration provides basic financial support for the station and pays a nominal fee to the four young women and three young men who, between them, present the morning sessions. But it is the interest of so doing, rather than the fee, which attracts them. In fact, all programming outside the weekday mornings is a voluntary effort.

Why not longer transmission hours, seeing that the station provides the only reliable signal on the Island on the broadcast band?

A spokesman for the Island Administration said that, in fact, the present schedules represent what can reasonably be maintained with available Federal Government finance and available voluntary effort.

He stressed that there is more to running a radio program than playing a few randomly chosen records, with interspersed — and perhaps random — comment.

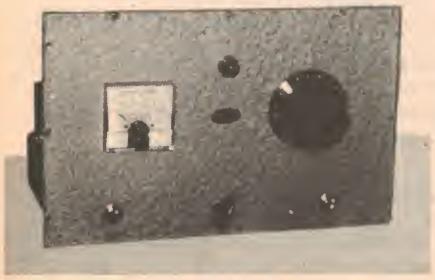
Even on a small community station attention must be paid to presentation. Programs must be planned and logged, records and tapes must be selected and cued, then filed away afterwards for later use. The correspondence, which any broadcast tends to generate, has to be handled and, all told, the work load multiplies surprisingly with increased programming.

There is another very practical reason: Operated in the present low-key manner VL2NI doesn't face too many problems with program rights, &c. The station is completely isolated; it serves only about 1400 local residents and approximately an equal number of tourists. It is neither "national" nor commercial, earns no revenue and is largely operated and maintained by voluntary effort.

If it were otherwise, it would tend to attract the "official" obligations of a professionally operated station.

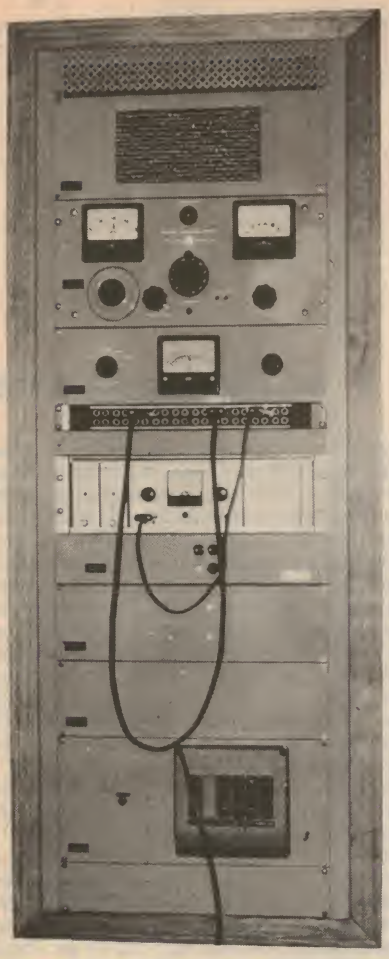
VL2NI operates on 1570kHz, with 50W fed to a ⅛-wave vertical antenna. The transmitter was produced by Commonwealth Electronics and is fed by AWA line equipment, program compressor, &c.

A couple of years ago, technicians on the Island combined to fit out a much more appropriate studio in the same historic building which housed the Museum exhibits. Unfortunately, it was no sooner complete than a fire gutted the entire building, exhibits, studio, equipment and all.



This tiny transmitter, more appropriate to a "Ham Shack" than otherwise, is on hand in case the main transmitter should fail.

Part-time announcer, Margaret Fitzsimmons, taking her turn in the tiny makeshift studio. At right, is Fred Jowett, who has inherited the task of keeping VL2NI on the air, largely as a matter of personal interest.



The AWA audio and line equipment, which feeds the signal to the Commonwealth Electronics transmitter, standing nearby.

Hence the small room in the transmitter building and a collection of consumer audio equipment that a tourist might otherwise have bought and carried back to Australia. There are two Pioneer turntables with magnetic cartridges and a small preamp/-mixer put together by Fred Jowett who, most times, will be found tending the equipment in the nearby Ionospheric Prediction station (see our September 1969 issue).

The microphone is a Sony 600-ohm dynamic which still feeds through the preamp circuit of a Sony reel-to-reel tape recorder.

I suggested an "Obscurity Corner" segment, as per the ABC, with listeners invited to submit interesting old recordings to be played over the air. It seemed like a good idea except that Fred Jowett would have had to find enough spare time to locate and rig up a 78rpm player!

And that's the way it tends to be in an enterprise depending so heavily on personal, voluntary effort.

VL2NI is undoubtedly an important part of everyday life on Norfolk Island and keeping it on the air might seem like a satisfying challenge.

But there's an implicit lesson for any group which might tend to regard a community radio station as a push-over, be it in a Pacific Island or in an urban community. It needs long-term dedication, not just a passing enthusiasm, to keep such a station on the air in a meaningful way, year in and year out!

Converting your TV set to colour: how practical?

Following recent stories in the daily press on the conversion of black-and-white TV receivers to colour, we have received many requests from readers for guidance. To convert, or not to convert? This article tries to take a realistic look at the pros and cons of the situation.

by JAMIESON ROWE

Late last year, many of the daily papers carried a story about two final-year students at the Royal Melbourne Institute of Technology, Drago Cernjavic and Miroslav Bubla, who had produced a "black box" conversion unit to modify existing black-and-white TV receivers for colour viewing. The claim was made that an 18-inch set could be converted for a total cost of about $150, including labour.

As this cost compares very favourably with the projected price of around $570 for a new 18-inch colour receiver, the story naturally aroused much interest. The press kicked it around for all it was worth, and the obligatory polite interest was shown by the ABCB and the Minister for the Media.

But not much interest was shown by the technical press, including EA. The few electronics industry people who ventured to comment on the matter were rather skeptical and unenthusiastic.

Why? Are we electronics people just knockers, prevented by our technical conservatism from recognising any new and worthwhile development? Aren't we interested in helping the poor viewer change over to colour without spending a fortune?

The answers to these questions are "no" and "yes," respectively. Most of us in the electronics industry would be delighted to find a way of significantly reducing the cost of colour TV reception. It's just that when one takes a long, hard look at the facts of the matter, it seems very unlikely that such a way has yet been found. I wish it had, with the time fast approaching when my own family finances will be under heavy pressure to part with the necessary cash!

Technically, it is certainly quite feasible to convert a black-and-white TV set — almost any such set — to colour. But just how much trouble, effort and cost will be involved are another matter. It is this "economic" side of conversion, rather than the technical side, which ultimately determines the practicability or otherwise.

Superficially, a colour conversion involves only two main tasks: replacement of the existing black-and-white tube with a colour tube, and the addition of an electronic "black box" containing the essential colour demodulation, decoding and driver circuits. Neither of these seems of itself to be unduly complicated, nor even unduly costly.

For the dedicated and experienced enthusiast or the technician doing his own set, the parts needed for these tasks will perhaps cost around $140, assuming an 18-inch set; the labour will of course cost him nothing — out of his pocket, that is!

But in the case of the average non-technical viewer, paying to have the job done on a commercial basis, these two superficial tasks will already have accounted for a sizeable outlay. Retail cost of an 18-inch tube is likely to be about $120, and for the "black box" I would estimate another $80. And if we allow a time of say four hours, this will bring the bill so far up to around $235.

And the sad fact is that for most sets, the two aspects of conversion which we have considered this far are only the start!

For example, it is not sufficient simply to replace the monochrome tube with the new colour tube. The only type of colour tube likely to be available for conversion use in the foreseeable future, the delta-mask type, requires a fairly elaborate unit called a "convergence yoke," in addition to the normal deflection yoke. And the convergence yoke must be provided with the appropriate AC signals, derived from the sweep circuits. This calls for additional parts and circuitry. Retail cost of the convergence yoke and other parts could account for around $40, to which one would probably have to add at least another $20 for more labour.

There is also the matter of EHT (extra high voltage) supply. A colour tube needs considerably higher EHT than a monochrome tube of similar size, yet at the same time it draws more than three times the current. The EHT power requirements are therefore considerably increased, along with the need to generate greater voltage.

Depending upon the set, this could involve anything from simple addition of a voltage multiplier system to a complete rebuild of the horizontal output and EHT section, or the provision of a new and completely separate EHT supply. If we say that an "average" set will need only a partial rebuild of the horizontal section, this is likely to add another $50 or so for parts, and say $30 for labour.

As you can see, the likely retail cost of the conversion has now climbed to around $375. And we haven't finished yet.

Until now, we have assumed that all of the "front end" of the set is quite suitable for colour, and will need no attention. Unfortunately, for a very significant proportion of sets this will not be so. Even when new, their tuner and IF strip response would have been quite incapable of dealing with a colour signal without virtually destroying the colour information.

In fact, for the vast majority of sets it would be necessary to give them an IF realignment at the very least. And in order to obtain the required response characteristic,

RMIT final year student Drago Cernjavic adjusts a converted monochrome receiver at a demonstration given late last year for the press and the ABCB.

it would probably be necessary to modify at least some of the damping resistors, and add two additional traps. The whole operation is likely to involve a skilled technician in something like three hours work, in a typical case, and cost around $30 for parts and labour.

Another assumption we have made is that the main power supply of the set is capable of meeting the additional demand which is to be made on it. If we're lucky, this may be so, although we may need to replace or add another big electrolytic or two, at a cost of around $5 each retail.

And it would be wise to add an automatic degaussing circuit, to obviate the need for frequent servicing. This will perhaps add another $10 for parts and labour.

Assuming that we can fit the resulting colour set in the old cabinet, and that we are happy to do this, our retail cost has now climbed to a figure of around $425. If you want a nice new cabinet, this would probably become $450.

This is not far short of the likely cost of a brand new 18-inch colour set. And the resulting converted-to-colour set will always be just that; like an early Volkswagen converted into the latest model, it will never be quite as good as "the real thing" . . . .

If you're a dedicated enthusiast, with plenty of experience, equipment and time, it would no doubt be a rewarding project. There will be plenty of problems to solve, and the comforting thought that you're saving at least a reasonable amount of money by doing the job yourself.

Similarly, it would make a fine project for students at technical college, with parts available at low cost, and the equipment, expert advice and labour all readily available.

It may be a proposition also for TV rental companies, with large numbers of identical sets. With a standardised conversion kit and procedure, it might prove significantly less costly than simple replacement.

But if you're just a normal viewer, with no technical background, looking for a way to get good colour pictures at low cost, I'm afraid you may as well forget it. Even assuming you can find a firm willing to tackle the job, the cost is unlikely to be much less than that of a new set. And it's unlikely that the firm will be prepared to guarantee the final result.

Not only this, but it is likely to be far harder to get finance for a conversion than for the purchase of a new colour set.

Although new techniques may reduce the cost of the colour decoder "black box," this is unlikely to alter the basic situation.

Cable TV: the long awaited dream — part 4

Recently, there has been much talk and speculation about what the future holds for cable TV. However, in this, the final article of our four part series, the author looks at what's available to cable customers today, and discusses the role of commercials on cable TV.

by LES RICH

"In time, cable television may influence the way we live as radically as the automobile and the telephone have done," or so it says in a recent study by the think-tank Rand Corporation. In the meantime, however, what has the cable done for us lately?

Well, everyone agrees that cable TV generally does a good job of fulfilling its primary purpose, that is, exorcising "ghosts" from the TV screen in rural areas. But what does it offer in the way of amusement or information that you wouldn't get otherwise? Currently not enough to wean many viewers away from, say, "Wait 'Till Your Father Gets Home." Quite probably the only dedicated cable-channel viewing in North America is in Toronto, where blue movies are being shown, and in New York, where wild-eyed basketball and hockey fans get the home games of their teams from sold-out Madison Square Garden.

There are a few other things of some interest. Sterling Manhattan (recently sold to Warner Cable) attracted considerable attention a couple of years ago with a community service program called Drug Line, which featured police, former addicts and others discussing subjects like methods of drug control and rehabilitation. More recently, this cablecaster has hooked up with New York Magazine for a resolutely chic show in which magazine writers talk about their smashing assignments.

And then there are the public access projects, like the one held recently at Public School 145 in New York City. Students and teachers from the school went out into the neighbourhood to interview local storekeepers, policemen and area residents. Other public access shows seen in New York include Teleprompter's serviceable neighbourhood news, children's shows, Spanish-language programs, taped versions of off-Broadway shows, and interviews.

Warner, at this writing is broadcasting old radio shows like "Fibber McGee and Molly" and the "Gangbusters" whilst the screen shows cartoon illustrations. This, of course, is a variation on a cable staple that is familiar all over the country — the musical backround that accompanies printed wire-service news or a stock ticker. Occasionally, though, something unusual happens, such as the time last fall when the cable was playing Joan Baez singing "Imagine" whilst Associated Press printed out Henry Kissinger's announcement that peace was at hand.

But lately, the unusual thing about some of these print-out shows is that there are commercials on them. Commercials for this tiny audience? They're rare. But some local marketers have found it profitable to sponsor the news or stock market reports.

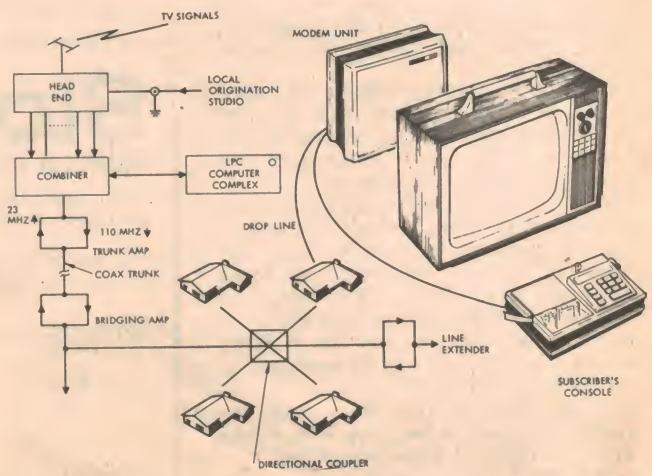
One reason is that although the viewers are few, the exposure is large. Generally the line "Presented by Apex Market," for instance, can be shown at the bottom of the screen throughout the time period. Another way the commercial message is reaching cable TV is through so-called "barter programming," in which a program is sent to the cablecaster free of charge — free because it has been sponsored by a company which has inserted its message in the show, usually in the form of a standard commercial.

Hundreds of cablecasters use programs distributed by companies such as Videomation, Perceptive Program Service and Time-Life Books. The cost of sponsoring these programs typically runs out at only $3,000 to $4,000 for a market of 50 cable TV systems. The point is that shows like this can be directed to cable TV markets where the book company's salesmen can't be sent — usually because the population is too small. Thus they fill in their marketing gaps at comparatively small cost.

This kind of show lends itself to fields like the book industry. For instance, three book publishers last year underwrote a series called "A Look at Books," made by Cable Shows / Video, Incorporated, New York. The format was a typical TV talk show, with authors being interviewed. There was a soft-sell commercial for the books in question at the end of the show, and also space for a local commercial to be used by the station.

But the most frequent use of cable TV as a commercial medium right now is probably in the area of testing commercials. Big advertisers, in case you hadn't noticed, are desperately anxious to learn your reaction to their latest creation, which has been

Teleprompter's two-way home terminal unit permits subscribers to instantaneously choose program material.



The above diagram illustrates how the home terminal unit is incorporated into a typical CATV system.

specially designed to give you a case of the grabs on your next visit to the supermarket. The advertisers have found that cable TV offers them the chance to get a reaction under test conditions, because a commercial being carried on a regular channel can be cut out and substituted for by a new commercial that just goes to those who are watching by cable.

These advertisements are then followed up by one of the marketing research companies, such as Burke Marketing Research, Cincinnati, whose procedure is to make random telephone calls to cable viewers. One company, Television Testing Company, New York, goes through an elaborate system starting with newspaper ads about the movies to be shown, random phone calls to test viewer reaction to the brands about to be tested, and then follow-up calls after the show to get different answers (they hope) to the same questions.

Some experimental projects have even gone further. Customers are equipped with two-way devices that allow them to push buttons in instant response to what is shown over their screen. It would be awfully easy to take a vote on almost any subject, for example response to an ad, presidential preference, etc. Beyond that, there's much loose talk about triggering in-home devices so that coupons, for instance, would fall out of the TV set on cue.

One example of two-way communication for cable TV is the computerized pay-TV venture recently introduced in Redondo Beach, California, by Home Theatre Network. Each viewer is equipped with a small electronic ordering device called a "Perk". The viewer simply punches in the program he wants to see, together with the time period. He then dials the computer's telephone number, attaches the "Perk" to the earpiece for 30 seconds, and orders his show. Then all he has to do is turn on the right channel at the right time.

Another two-way home terminal unit currently undergoing field trials is the SRS Model 102 Subscribers' Console of Teleprompter's Premium Television system. This system permits cable subscribers to instantaneously select programs without the need for phone calls, ticket purchases, plastic cards, or other devices.

Which gets us back to the revolution that hasn't happened, but which may occur by, say, the early 1980s. Says Ken Simindinger, Washington general manager for Burson-Marsteller: "The most significant development of all will be that the 'wired nation' or 'global village' will not be an interconnection of passive viewers. CATV will provide each viewer with the ability to communicate back . . . while actual provision of two-way terminals and services is not mandated (by the FCC) at this time, it is inevitable and imminent."

Cable TV has its obvious enemies. Julian Goodman, president of NBC, said last May that "if left to the normal economics of the marketplace, cable TV will never become a major mass medium." But "cable television may be pushed in a direction that is contrary to the public interest, simply to counterbalance television." This could happen if the cable is allowed to "siphon off the television staples it is reaching for — sport and feature films," because of the government's "failure to apply proper copyright liability to an operation that takes our television programs and distributes them to distant areas for a charge."

After more than 30 years, cable TV finally seems ready to charge the Bastille in its often-postponed revolution. And the king's getting nervous.

Eight microwave dishes measuring from 4 — 10ft in diameter are used by Mission Cable Two for receiving and transmitting from this Cowles Mountain site.

Studio supervisor Jim Hancock checks on program material at Mission Cable Two's main studios.

Above, a technician installs multi-tap overhead cable for Arron Cablevision.

Our New Playmaster 140

Continuing our description of the Playmaster 140 quadraphonic amplifier, we describe in detail here the construction and installation of the preamplifier / tone control module. Also covered is the EA Stereo-24 adaptor module and another to change the phase of rear channel signals fed in via the Ext-4 socket.

by NEVILLE WILLIAMS — PART THREE

Just before proceeding, a couple of points arising from earlier articles could be clarified to advantage.

McMurdo have quoted a revised part number for the Hi-Lo filter switch assembly. The simpler assembly used in our prototype and listed as S/4700 can alternatively be identified by the new part number 2713/2. The assembly which includes the power switch and listed as S/4727 can be identified alternatively as McMurdo part number 2733/5. The company stresses however, that either number will identify the switch required.

The second point has to do with the first transistor in the power module, which was shown as type PN5088. It should read 2N5088. Despite the "2N" prefix, the transistor is in the general T092 class and uses the connections as shown on the circuit diagram.

Now to continue:

Having installed and checked the power modules, the next obvious step is to build and install the preamplifier and tone control module; this is secured to the chassis floor on four pillars in the space between the power modules and the panel controls.

The preamp and tone control unit is essentially similar to that used for the Playmaster 136, with just a couple of minor changes in circuit values. Had the sequence of events been different, we might have incorporated the preamp circuit featured in our November '73 issue but, in fact, the prototype 140 was well advanced before this latter work was done. The differences were not such as to warrant discarding a front end which was already operating and widely accepted.

For your guidance, we show the schematic circuit of one channel of the preamp-tone control module.

The compensated preamplifier uses two selected gain silicon transistors — a high gain low noise type (BC109C or BC549C, &c) and a medium gain BC108B or BC548B, &c. The types specified are the ones most likely to be supplied but the "&c" indicates the existence of possible substitutes.

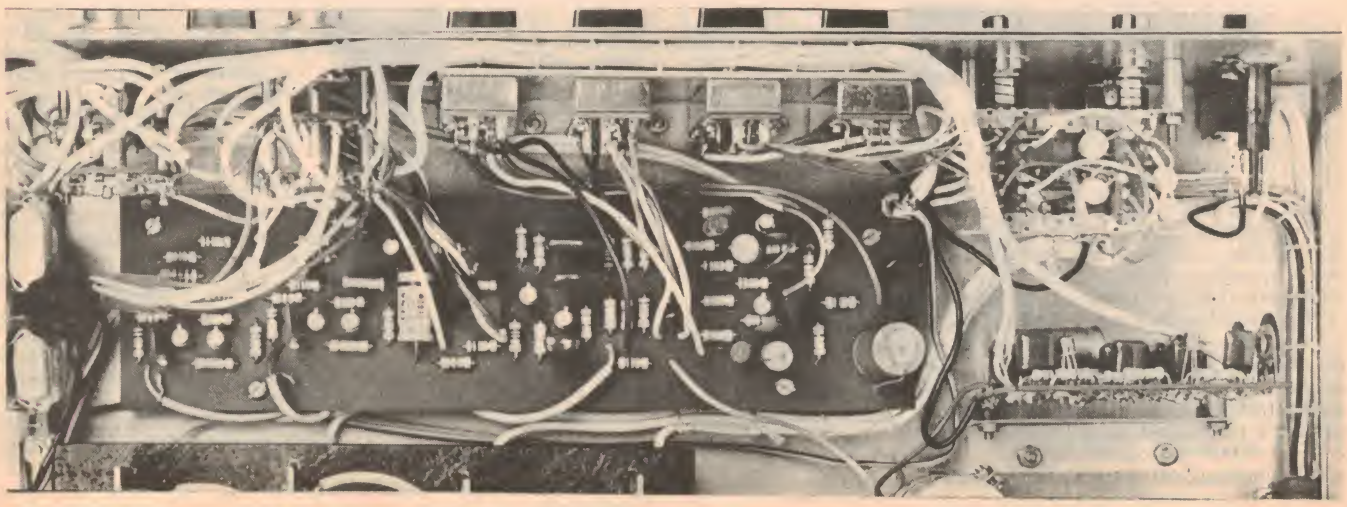
However, in addition to the electrical characteristics of possible alternative types it is important to take note of the connections.

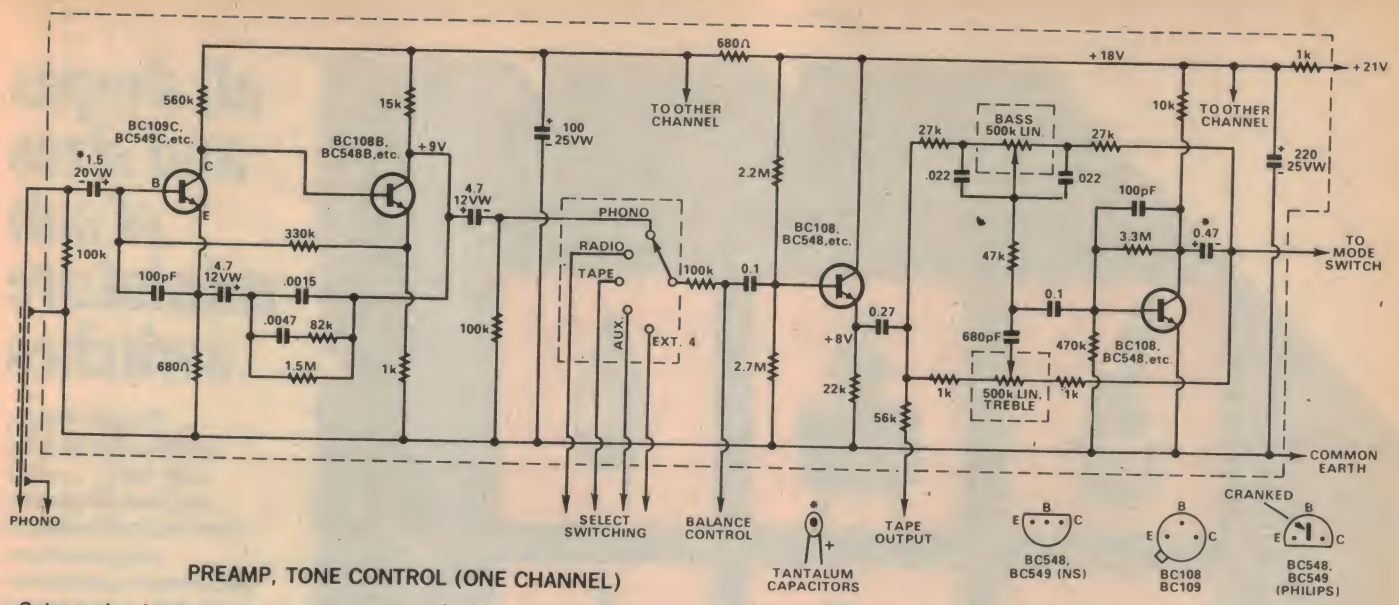
The 72sa10 board is drilled for transistors having the traditional triangular CBE lead configuration. Transistors of this type can simply be dropped straight in, with little risk of confusion.

Difficulties could arise, however, with transistors in the new TO92 pack, from which the leads emerge in line. With the "BC54 . ." series, as released by Philips, the Base lead is normally cranked back under the transistor body so that the connections have a similar triangular configuration. The transistors can simply be pushed down as far as they will comfortably go, and soldered into position.

If you are supplied with TO92 style transistors of another brand, check the base

A plan view of the amplifier, with the preamp and tone control board occupying the area immediately behind the potentiometers. Note that the connecting leads have deliberate slack. The Stereo-24 decoder is seen edge-on, at the right.

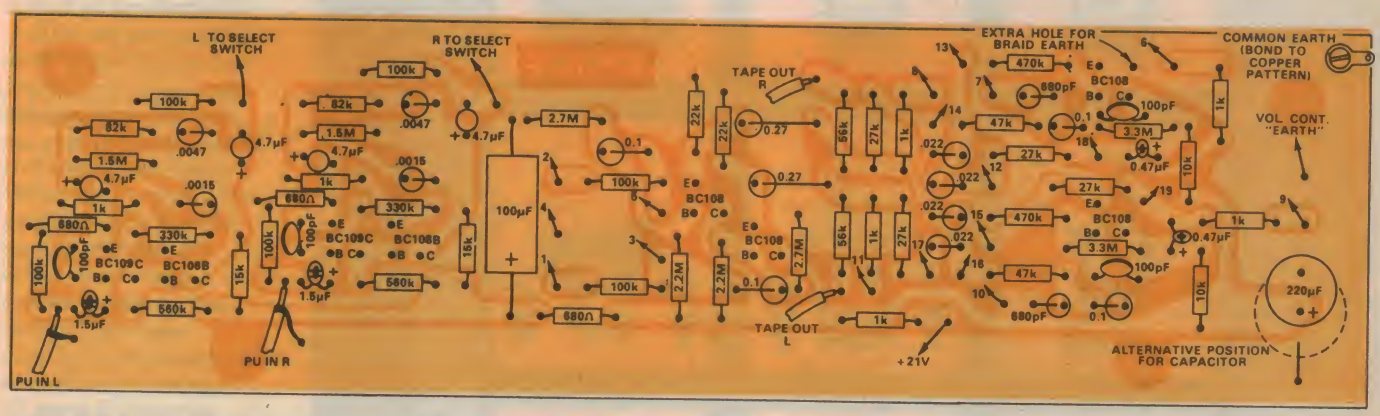




PREAMP, TONE CONTROL (ONE CHANNEL)

Schematic circuit of the phono preamp and tone control board. Take particular care if you are supplied with transistors other than those specifically shown. Check against the manufacturer's own data. Basing conventions vary from one brand to another, in some cases even for the same type number.

Below: The layout of components on the board for the phono preamp and tone control stages. We have specified the same board as for the Playmaster 136 but you may have to drill a couple of extra small holes to accommodate additional wires or slightly different components.



connections carefully. For example, in the N.S. range, the BC548 does not have a cranked base pin and the lead sequence is reversed in relation to the flat on the body.

Electrically, the preamplifier provides enough gain (75 times) to ensure full drive to the main amplifier from an input of 2mV RMS, with good signal / noise ratio and adequate tolerance to peak level input signals. It provides a nominal loading of 50k ohms for a magnetic cartridge and compensation which conforms closely with the required RIAA characteristic.

Output from the compensated preamplifier goes to "Select" switch, where it is made available, along with signals from other sources: radio tuner, tape player, auxiliary input or external 4-channel input. Since the signal levels at this point are normally 150mV or higher, shielding is not a critical requirement. It has been specified for long lead runs, but the switch banks, shorter leads and other associated circuitry are open, relying only on sensible layout to avoid instability problems.

From the Select switch, the signal passes to an emitter follower, which presents a fairly high impedance to the various signal sources, and a low source impedance for the tone control circuitry. At the same time, it provides a convenient point from which to derive signal for an external tape deck; this signal is independent of the amplifier's own volume and tone controls.

The tone control circuit is of the feedback type, favoured because of its inherently low distortion and its tolerance to higher level input signals.

The point should be made, however, that signals derived from the Select switch are applied directly to a transistor base and can overload the circuitry between this and the volume control, if the level is excessive. Signals from radio tuners, tape players, &c, must be limited in some way if there is any suggestion of overload, or if you find that the amplifier is being fully driven with the volume controls only fractionally on.

In constructing the preamp-tone control module, a useful first step is to check the fit of the board and chassis mounting and make any adjustments necessary by filing holes, &c. We used ½in threaded pillars, with ¼in long ⅛in diameter countersunk screws securing them to the chassis and ¼in long ⅛in diameter roundhead screws securing the printed wiring board.

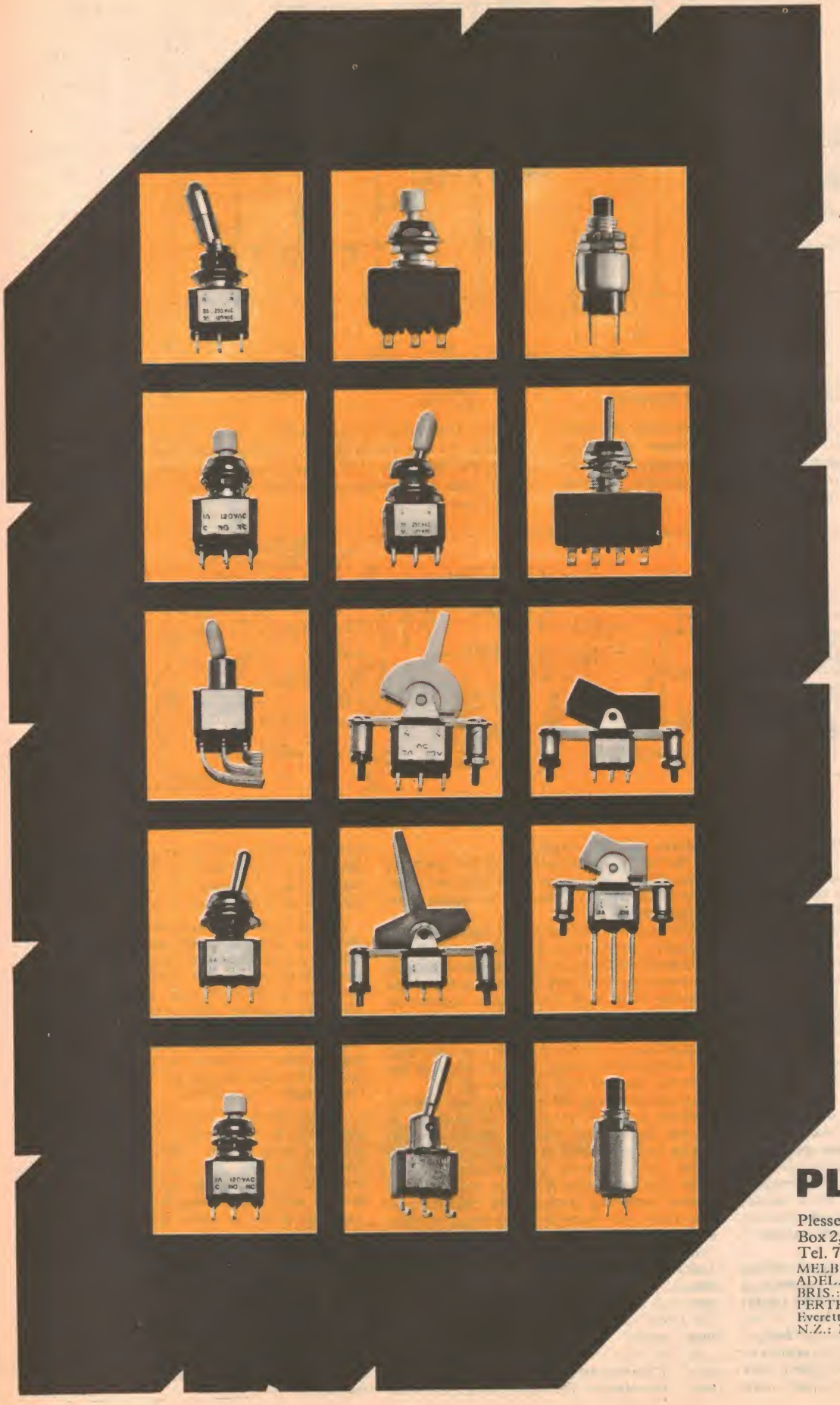
However you arrange it, remember that there must be no direct circuit between the copper pattern and chassis. As indicated in previous issues, the only earth must be via the phono input braids back to the phono input socket.

To provide a common earth point for other circuitry, we suggest you add a solder lug to the corner of the board adjacent to the filter switches, bolting and soldering it to the earthy copper pattern. The existence of such a lug is indicated in the diagram on page 33 of the December issue.

For the rest, the components drop into place, as per the accompanying drawing. Polarity is important only in respect to the electrolytic capacitors, and this calls for some care. Note that we have shown an alternative position for the main decoupling capacitor, in case it happens to be larger than the one originally planned. An extra hole may be required and, for this, you will need a fine twist bit and, preferably, a small "egg-beater" hand-drill.

As indicated, an extra hole will also be required for the shield braid of the leads running back to the "Mode" switch. We have suggested that constructors cope individually with these minor matters to save us originating a new board pattern for the sake of two or three extra holes.

The most tedious job with the module has to do with the leads which must ultimately connect to the potentiometers and switches. The leads range from about 3 to 7 inches long and are unshielded, except where otherwise indicated. It is a good idea to use as many different colours as possible to facilitate lead tracing, and to use thin rather than thick hook-up to retain maximum flexibility.



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AC84

The leads should be anchored to the wiring board during initial assembly and left trailing. Please yourself whether you make them all generously long, or save wire by cutting each one discretely to suit the requirement. But, whatever you do, plan for each wire to follow a gently curved path so that the board can be unbolted and lifted up for testing or service. For the same reason, leave some slack in the phono input and tape output leads, which run back to the DIN sockets.

Numbers 1-19 on the board wiring diagram relate to numbers on the main diagram (p33 Dec issue) and indicate where each lead goes.

With the module in position, wired and checked, and connected to the plus-21V supply line, the amplifier could operate in normal stereo mode from phono or other inputs. The signal and earth paths should have been established from the phono input socket, through the copper pattern on the preamp-tone control module, thence to the Hi-Lo filters and volume controls, and to the input connections to the four power modules.

Just make sure that any other temporary or accidental earth path has been obviated.

One other point we should mention: If you do operate the amplifier in this semi-finished state, remember that you have two volume controls and four power modules. While operating one volume control, two modules and two loudspeakers, it is all too easy to have the other volume control advanced, and be overdriving the other power modules without knowing it. It wouldn't necessarily cause trouble but care is usually preferable to lament!

If this much of the amplifier is working normally, it will be driven to full listening volume by an average magnetic cartridge, with the volume control(s) about halfway up, in terms of physical movement. Frequency response will be level with the bass and treble controls at about half setting though, in our prototype, they needed to be about ⅛in above centre for a nominally flat response.

In these circumstances, lifting the pickup off the record and leaving the controls untouched, the amplifier should sound dead quiet from the listening position. Only if you put your head right up to one of the loudspeakers should any hum or hiss be audible, and then only faintly, with loudspeakers of the usual modern compact design.

4-CHANNEL DECODER

The options in respect to four-channel operation were discussed in the December issue but we are assuming at this point that most readers will start off by duplicating the arrangements in the prototype amplifier. This involves wiring to the "Mat 1" position of the Mode switch the EA Stereo 24 Adaptor, similar to that described in our November 1972 issue.

The particular version is the one shown on page 29 of that issue, on printed wiring board 72 / s11. It has the advantage of being smaller than the Veroboard version and somewhat simpler to assemble. BC108 transistors were used, instead of the 109 series, although there would certainly be no objection to retaining the latter if you want to use or adapt an existing unit. Other minor changes will be noted.

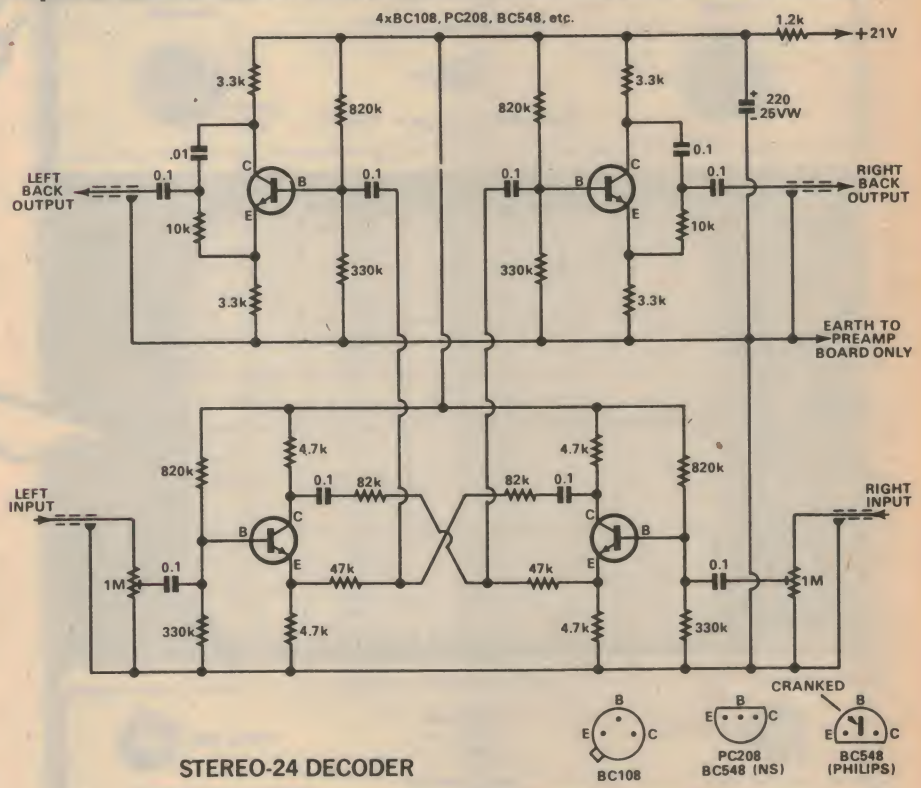
The Stereo-24 Adaptor is intended to process signals already being fed to the front channels and, from them, to synthesise signals for the rear channels.

With this in view, the left and right signals are made available respectively to two NPN transistors, operating with equal loads in the collector and emitter circuits. It is, in fact, the old time phase-splitter configuration which provides a pair of out-of-phase signals, each about 0.9 the amplitude of the original input.

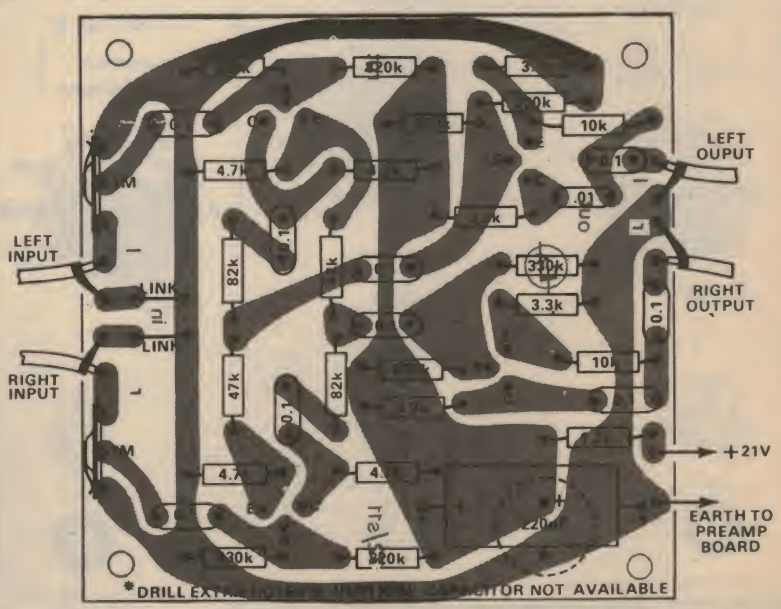
A network of resistors merges the four outputs in such a way that a "mono" or "centre" signal that is common to both channels is partially cancelled; as a result, "difference" or ambience signals become relatively more prominent. These "processed" signals pass through the upper transistors in the schematic circuit to their respective rear channels.

For example, a signal in the left front channel will be applied to the base of the lower left transistor and will appear at slightly reduced amplitude at the emitter. If it is unique to the left channel, it will be fed through the 47k resistor, with a further loss of amplitude to the base of the upper transistor feeding the left rear channel.

However, if a similar signal is present in the right channel, an out-of-phase replica



STEREO-24 DECODER



Above: Circuit details of the decoder and synthesiser module, which is essentially similar to the original Stereo-24 unit featured in November 1972. A minor refinment would be to increase the output coupling capacitors from 0.1uF to 0.47 max, with a 220k resistor from the output side to the earthy copper pattern.

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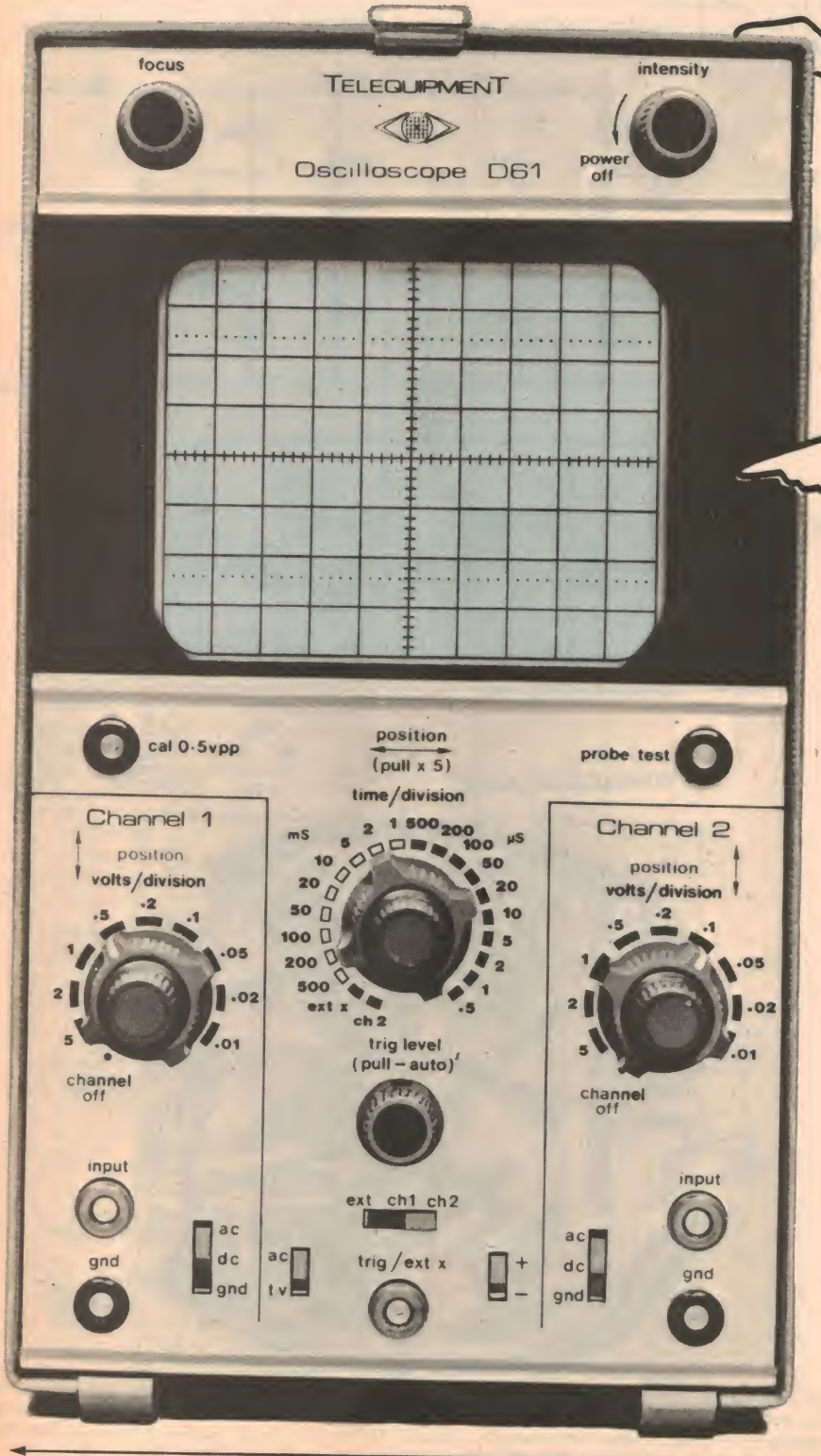

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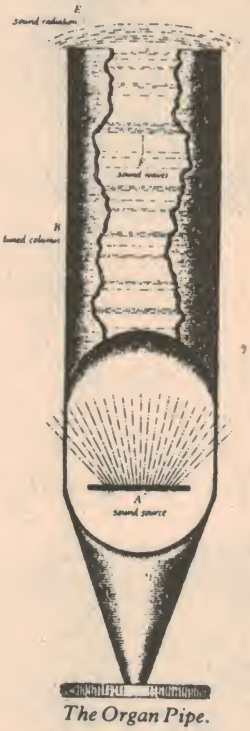
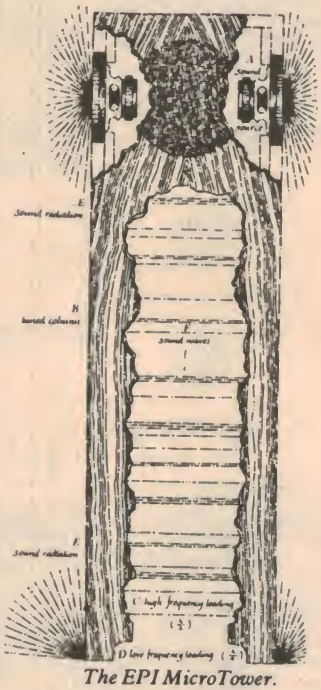


The Organ Pipe.



The EPI MicroTower.

What this remarkable breakthrough means to the quality of the sound is something remarkable, too:

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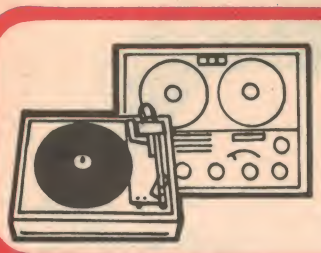

Hi Fi News

August: "75 Sounds Spectacular"

The Australian HiFi industry faces 1974 with a booming demand for equipment and a new spirit of initiative and co-operation. As we mentioned last month, the newly formed High Fidelity Industry Association is finalising plans for a big HiFi show in Sydney's Centrepoint Complex during August. Under the title "75 Sounds Spectacular" its aim will be to present the challenge of high quality sound to the public at large.

by NEVILLE WILLIAMS

A change in emphasis is one of the reasons why the Association has taken independent action.

In the past, many HiFi shows have been presented in major centres, with varying degrees of success. There is a feeling, however, that they have tended to be a rather "in group" activity, involving mainly the "already converted".

To be sure, the "already converted" have largely supported the industry to date, both by buying its products and by carrying the banner for higher quality sound.

But what about all the John Citizens who don't happen to come in contact with a HiFi enthusiast? The "75 Sounds Spectacular" will be brought to their notice through the mass media, as well as through specialist HiFi and technical publications.

John Citizen is already exposed to a great deal of publicity for disc and cassette players, 2-channel and 4-channel, portable and furniture style. But the emphasis is usually on price. Provided the record spins or the tape travels smoothly and reliably, and provided the sound is pleasant, there the matter ends!

But if many such customers had been given the meaningful option of paying somewhat more for better quality sound, they may well have elected to do so. But herein lies a problem:

For various reasons, high fidelity equipment has been surrounded by a certain "mystique". It has been owned and talked about by people who seemingly had a "kink" in that direction, and the money to indulge it. It has traditionally been purchased from shops that one didn't frequent, unless one could speak the language of cycles and bels!

But, if one did perchance enter the precincts to seek a few answers, there was a good chance of being assailed with the merits of the equipment on display — and the demerits of everyone else's.

All very off putting!

A couple of years back, some industry executives in Sydney and Melbourne decided that it was time to change the industry image: to eliminate some of the mystique, restrain some of the false advertising, and to stop ridiculing the other man's products.

"Let's encourage rather than confuse the man in the street, and let him choose what most appeals to him. That way, we'll all be better off!"

These sentiments found expression in meetings which were convened towards the end of 1971, involving a cross-section of industry leaders, representatives of the Institution of Radio and Electronics Engineers, the Standards Association of Australia, and the trade and technical press.

Subsequently, I wrote an editorial for the December 1971 issue, commenting on the position as we then saw it. I think it will bear repeating:

"How high is the Hi in HiFi?

"How loud is the loud in loudspeaker?

"Which watts should one use for power ratings?

"These, and other such questions, more seriously phrased, have bedevilled the audio industry for decades — both here and overseas.

"Audio people the world around have expended many evenings in solemn conclave deliberating upon standards for equipment — how they should be determined, interpreted, observed and enforced. But their daylight hours have as often been spent playing the numbers game: Manipulating figures to 'prove' that their particular product offered the biggest result for the smallest outlay.

"It has been obvious for a long time that the numbers game is self-defeating. Everyone can play it, everyone can ridicule everyone else; but the end result is to confuse and deter the very customers the industry needs to encourage.

"Largely as a consequence, there has been a firming of support for bodies seeking to propagate standards by which the performance of audio equipment can be reliably determined and categorised. What is more, there are encouraging signs that national standards bodies are becoming less concerned with defending their own ideas and more concerned about reaching common decisions.

"Last month, a meeting was held in Sydney, in the Committee rooms of the Institution of Radio and Electronics Engineers. Its purpose: To examine the problems of the audio industry in Australia, with due reference to the burgeoning domestic high fidelity market. It was encouraging to sit down with members of the IREE Council, the Australian Standards Association, representatives of major companies and other media — and to sense a common concern for the welfare of the audio / hifi industry and of the public on which it must depend for its very existence.

"A spokesman for the **Standards**

The Pioneer "Prelude 4000" quadraphonic system, pictured above, is the latest addition to the Company's expanding range of complete systems. Intended to retail at $499, the system is built around an AM / FM tuner amplifier, with in-built facility to decode RM and SQ 4-channel / recordings, and to accept signal from an external discrete source. Full volume, balance and tone controls are provided with a power output capability of 7W RMS per channel. The player features belt drive, a magnetic cartridge and automatic facilities. The Prelude 4000 is available now from all dealers. FOOTNOTE: Pioneer distributors for Tasmania, Audio Promotors of Tasmania Pty Ltd, are now at 263 Tasman Highway, Bellerive 7018. Telephone is Hobart 44-4783.

Association was able to outline to the meeting the relationship of his Association with similar bodies overseas, and the considerable progress that had already been made in co-ordinating standards for Australian conditions. It was pointed out also that many laboratories throughout the nation were accredited and able to certify equipment as necessary.

"There seemed to be no obvious barrier to marketing equipment, in due course, with a swing-tag certifying that it conformed to SAA specifications.

"Spokesmen for the IREE indicated that the Institution has been considering the establishment of special interest groups in the audio field and that these could provide an impartial meeting ground for discussion and exchange of information.

" 'Electronics Australia' stands squarely behind these chartered national bodies in their joint effort to bring order into a situation which the buying public finds quite bewildering."

Not surprisingly, the IREE opted out of the commercial aspects of the subject but, having done so, moved promptly to reinforce communication at a technical level. The past year has seen the emergence of an

The Aiwa TM-405 language laboratory cassette recorder is to be marketed in Australia by Goldring Engineering.

active Audio Group in Sydney and a series of well attended lectures on general audio subjects.

More about the Standards Association later.

The need for a forum and a voice at commercial and organisational level has now been met by the formation of the High Fidelity Industry Association. And the first major venture of the Association has been the launching of its own HiFi show.

Because the organisation of such a show demands something far beyond the scope of voluntary effort, the Association has retained the services of a company which has specialised in exhibitions, locally and overseas, for many years. The official press release reads as follows:

The High Fidelity Industry Association will hold its first major promotion in Sydney next August. The show is being organised in conjuction with IPC Exhibitions Pty Limited. The modern and highly active Centrepoint, Sydney, has been selected as the venue.

High Fidelity Industry Association President, Mr Les Black, said: "Increasing public interest in hifi equipment made it an ideal time for the exhibition. Our Association and its members, and indeed the whole industry, should be behind this promotion. It is in all our interests to ensure the public is fully aware of the equipment we have available in Australia.

"A special sub-committee of the High Fidelity Industry Association has been formed to work closely with IPC Exhibitions

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JK5967

Inside front cover (p. 2)

HIFI NEWS

Pty Limited. Already arrangements for a wide and exciting program of advertising and promotion in mass circulation media is under way. The aim of the exhibition is to give the public the true story of hifi / audio sound under ideal conditions," Mr Black said.

"Visitors to the exhibition will be able to see, hear and compare equipment from all over the world. We have magnificent products and the public should know about them," he said.

The main aims and objectives of this exhibition are to establish in the minds of the public, the unconverted market, the beauties, benefits and pricing of hifi / audio equipment.

The exhibition area has been designed to give excellent display space for 70 presentation areas. A demonstration sound theatre in which programs encompassing the entire spectrum of musical experience from chamber music to pop will be conducted. It will illustrate the sound and versatility of the equipment available.

Exhibitors are offered a package deal of:

- Space in the exhibition, including complete display "shell" construction. This consists of carpet floor, side and back walls, lighting and name panels.
- Their own advertisement in the souvenir program given to all visitors to the exhibition.

Association members have already shown enormous enthusiasm for the show and as participation is not restricted only to Association members it is anticipated the industry in general will take part.

Further details are available through:

Mr Bill Martin, Secretary,
HIGH FIDELITY INDUSTRY ASSOCIATION
c / — Jervis Australia Pty Limited
1 / 111 Old Pittwater Road,
Brookvale 2100. Tel: 939 2922.

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Mr Tony Farrington, Director,
IPC EXHIBITIONS PTY LIMITED
3-13 Queen Street,
Chippendale 2008. Tel: 69 5651.

Information to hand, since receipt of the foregoing release indicates that the "75 Sounds Spectacular" will run from Tuesday, August 27 to Saturday, August 31 inclusive, from 11am to 9pm.

It is likely that a modest admission charge will be made, partly to cover the cost of the special directory, and partly to ensure that people entering the exhibition area will not be entirely casual but will have some motivation in response to the media coverage.

Why the "75" Sounds Spectacular?

Because, say the organisers, a large proportion of the equipment on show will be new models which will remain current through the following year.

Furthermore, they want the Sounds Spectacular to have a broad, forward looking approach. Quadraphonic sound is already part of the scene but ahead lies a whole possible new era with the marriage of high quality audio and the visual arts and — who knows — a possible new era for radio in Australia!

Earlier, we mentioned the Standards Association of Australia, which was represented in the industry meeting convened in the Committee rooms of the IREE in Sydney, in late '71.

A letter just to hand from the Association indicates that it is currently constituting "a sub-committee on high fidelity reproducing systems under the authority of Committee TE / 24 — Electro-acoustics and Recording".

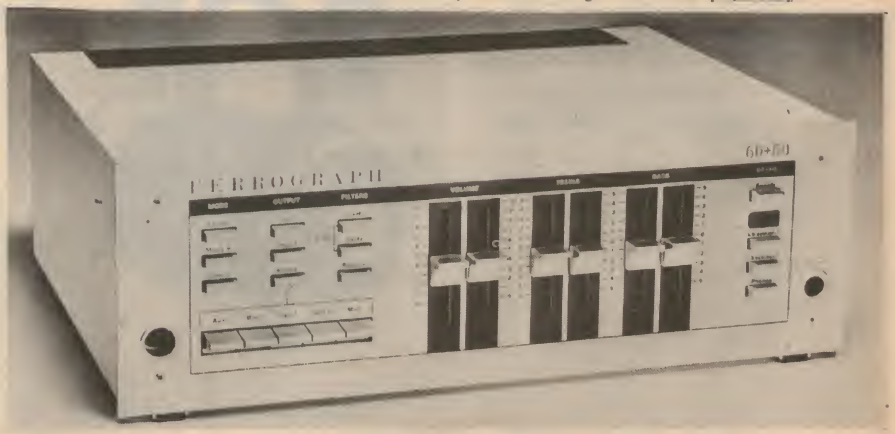
The aim of the new sub-committee will be to prepare a series of standards on high fidelity recording and reproducing equipment, similar in scope to DIN 45500, updated technically, and compatible with the international recommendations currently being prepared by the International Electrotechnical Commission.

The first meeting of the new sub-committee is scheduled tentatively for this current month.

Quite apart from pressure from within the audio industry itself, the Standards Association has been requested to expedite its deliberations by the Interim Commission on Consumer Standards.

"Electronics Australia" has been invited to nominate an appropriate person to the sub-committee, and this we propose to do.

In view of this, it seems likely that 1974 will see greater public awareness of the audio industry, coupled with an increasing degree of standardisation within it.



Retailing for around $447.50, the Ferrograph F608 Stereo Amplifier is distributed in Australia by Leroya Industries Pty Ltd, 266 Hay St, Subiaco, WA. Main features of the F608 include a power output of 60W RMS per channel and the exclusive use of pushbutton and slide controls.

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HEADPHONES

...or good listening while others sleep

Perhaps the most widely published of all headphone pictures, this lass and her early model AKG phones helped establish a new listening trend around 1960.

During the past few years, headphones have found wide acceptance with high fidelity enthusiasts and, nowadays, a hifi system is scarcely complete without at least one pair. But how does one make a selection from the many brands now offering and what about the most recent innovation: four channel or quadraphonic headphones?

Selection can indeed be a problem. It is not at all unusual to walk into a hifi shop and be faced with ten or a dozen different brands. Most of them sell in the range $12 to $30 but some run to twice the figure while the occasional pair, looking much like their dearer counterparts, can be picked up for less than $3.00. What makes one pair of phones twenty times more expensive than another?

The simple and appropriate answer is "they're better" — but how much better? Let's start at the beginning and see where we get to!

In the days of crystal sets and elementary valve receivers, headphones provided the normal means of "listening in", because they made the best use of the weak signals. It was not at all unusual to unclip the phones from the headband so that two people could hear the program simultaneously.

Electrically and mechanically, these early headphones were almost invariably adapted from the time-honoured telephone earpiece. They were heavy, they were hard, and they worked on the same principle. Each contained a small horseshoe magnet with iron pole-tips attached to its ends. A thin steel diaphragm was mounted just clear of the pole tips, attracted by them but not quite touching them.

Around each pole tip was wound a coil of fine wire and through these coils passed the signal from the radio receiver. The signal current through the coils produced an alternating magnetic field which interacted with the field from the permanent magnet. As the signal-induced field added to or opposed that from the magnet, the diaphragm would be more or less strongly attracted. It therefore tended to vibrate and, in so doing, created tiny air pressure waves which were heard by the listener as sound.

Headphones operating on this principle generally tend to exhibit resonance effects and to emphasise frequencies in the middle of the audible range. This is almost an advantage where the objective is to gain maximum intelligibility from weak voice signals, as from a telephone or an elementary radio receiver, but it plays havoc with the enjoyment of music!

When radio receivers, as a class, became powerful enough to drive loudspeakers, listeners were understandably only too glad to put aside headphones and to listen in greater comfort. And that's the way matters rested for thirty or more years. While receivers, amplifiers and loudspeakers enjoyed progressive improvement, headphones remained almost static — in limited demand by experimenters, radio amateurs and people involved in communications services.

But for quality listening . . . never; or almost so!

In fact, headphones faced a number of limitations. One has already been mentioned — that of restricted and peaky response. Another, also related to the mechanism, was a high level of distortion. And, again, there was the matter of convenience and comfort.

But even if all these had been overcome, a major problem would have remained, having to do with the nature of the signal itself. When an ordinary mono signal is fed to headphones, it tends to be highly "localised". In normal circumstances, with the phones operating in phase, at equal level, and worn by a person with balanced hearing, sound seems to be originating from a point right in the centre of the listener's head.

The sound is highly intelligible, but also highly unnatural. It is certainly quite inappropriate, when the object is to recreate the sound and spaciousness of an orchestra, or any dispersed group of performers.

The problem is present to some extent with a mono signal reproduced through a loudspeaker, but it is not nearly as acute, because echo and reflection effects in a listening room tend to spread the apparent source of sound. The larger the room, and the more reflective the surfaces, the greater is the dispersion effect.

With the development of stereo sound reproduction, some enterprising engineers realised that it could mean a new era for headphone listening. With separate left and right signals fed to the respective phones, the dreadful "point source in the head" effect disappeared, to be replaced by a dimension of sound even more dramatic than when heard from loudspeakers.

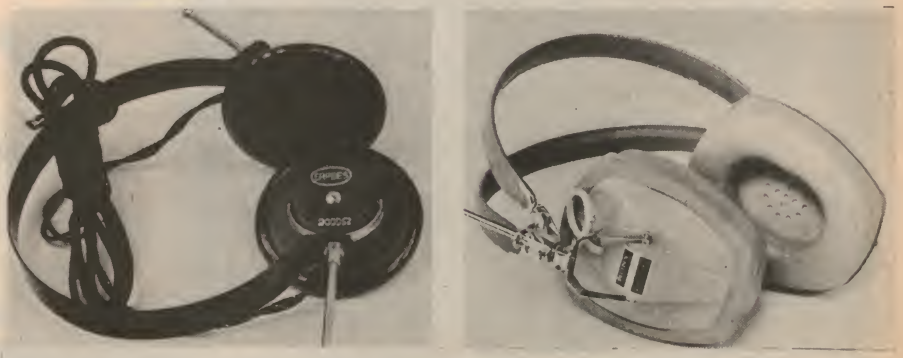
With this problem banished, it seemed worthwhile to evolve and produce headphones which, hopefully, would exhibit the wide frequency response and low distortion of the best loudspeaker systems.

As far as "Electronics Australia" is concerned, the hifi stereo headphone era had its effective beginning towards the end of 1960, when we received a pair of high quality AKG headphones, via AWA, representing the company in Australia. We listened to them, tested them and produced an adaptor unit which would allow stereophones to be connected to existing stereo amplifiers.

The result of this work was published in January 1961.

In that issue, we mentioned the rising interest in the subject overseas and listed seven brands which were available in the USA, some relatively new, others adapted from mono headsets that had been produced earlier to meet the very limited demand for higher quality phones.

Then, as now, we credited the new interest in headphone listening to stereo reproduction. To quote:



The old and the new: Much lighter than their early counterparts, the Erpees phones on the left nevertheless followed in the tradition of the magnetic type. The Sony dynamics are typical of those which took over for hifi-stereo listening. There are currently five different models in the Sony range, retailing from about $12 upwards.

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will appear at the collector of the lower right transistor and this, via the 82k resistor, will tend to cancel and diminish the "left" signal which actually reaches the upper left transistor.

The same will, of course, apply for what reaches the upper right transistor.

This partial cancellation forms the basis of most of the currently popular systems which synthesise 4-channel sound by loudspeaker matrixing. The Stereo 24 Adaptor incorporates a further subtlety, however.

The rear channel feed transistors which are also connected as phase splitters and the signal is taken from an R / C network strung between collector and emitter.

At low signal frequencies, where the reactance of the capacitor is high, the output comes effectively from the emitter and is in phase with the original front input signal. This means that low frequency energy from all loudspeakers will tend to be in phase, avoiding the "thin" sound that might result if it were otherwise.

At high frequencies, the signals come from the respective collectors while, in between, they are derived from both collector and emitter in a phase which varies with frequency between 0 and 180 degrees. The networks feeding the respective rear channels are deliberately different, such that there is an approximate 90-degree phase difference between the rear channels over the middle audio range.

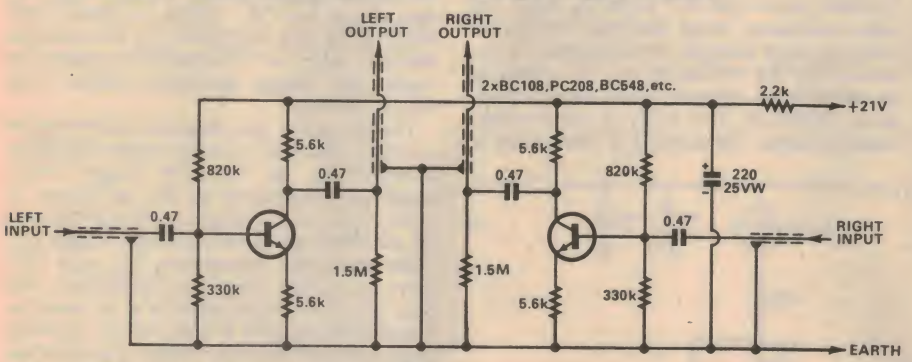
The partial cancellation and the progressive phase rotation in the rear channels, relative to the front and relative to one another, minimises any tendency for the system to produce a firm image of "mono" material at the sides or rear. Thus centre front signals tend to "stay put", while the side and ambience signals are dispersed, subject of course to the level in the rear loudspeakers.

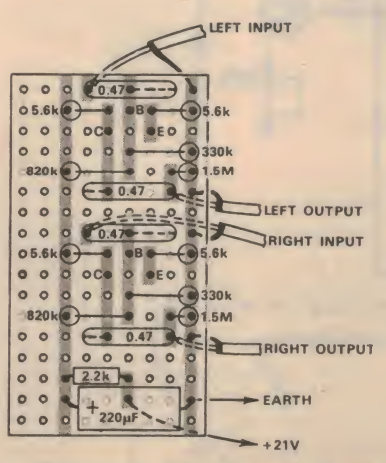
Experience has shown that the system works out very well indeed in synthesising quadraphonic sound from existing 2-channel recordings. It can also produce some very compelling effects from matrixed discs, even though the energy distribution may not be in line with the producer's original idea.

It was our original intention to derive the left and right signals for the Stereo-24 Adaptor from the output circuits of the front channel power modules — as was assumed when the unit was first devised. It was for this reason that preset input pots were provided on the board.

However, on this basis, the front volume control would have affected all four channels, making operation in this mode different from any other. To avoid this, the Stereo-24 Adaptor now picks up its signal from the tone control output. The preset pots are simply turned full on; in fact, they could be replaced by resistors and the signals fed directly to the coupling capacitors.

The effective gain through the Adaptor is less than unity but the imbalance between front and back channels is of no consequence in practice. If you want full "surround" sound, it is simply a matter of nudging the rear volume control a fraction of an inch above the front control; there will always be gain to spare.





Circuit diagram of the phase change module and a convenient method of assembly on a small piece of Veroboard.

PREAMP, TONE CONTROL, PHASE CHANGE MODULE

PREAMP TONE CONTROL

1 Printed wiring board 72sa10.
2 BC109C, BC549C or similar transistors.
2 BC108B, BC548B or similar transistors.
4 BC108, BC548 or similar transistors.
2 Ferrite RF beads 3.5mm dia, 5mm long, type FX1115.
4 ½in or 1cm spacers with screws.

RESISTORS (½W or ¼W, preferably 5pc)
2 3.3M; 2 2.7M; 2 2.2M; 2 1.5M; 2 560k; 2 470k; 2 330k; 6 100k; 2 82k; 2 56k; 2 47k; 4 27k; 2 22k; 2 15k; 2 10k; 7 1k; 3 680 ohm.

CAPACITORS
1 220uF 25VW vert electrolytic.
1 100uF 25VW vert electrolytic.
4 4.7uF 12VW vert electrolytic.
2 1.5uF 20VW tantalum electrolytic.
2 0.47uF 20VW tantalum electrolytic.
2 0.27uF 100V polyester.
4 0.1uF 100V polyester.
4 .022uF 100V polyester.
2 .0047uF 100V polystyrene.
2 .0015uF 100V polystyrene
2 680pF 100V polystyrene.
4 100pF disc ceramic.

STEREO–24 ADAPTOR

(See blockline, page 49)
1 Printed wiring board 72 / s11.
4 Transistors: BC108, BC548, PC208, &c.
1 Angle bracket approx 1 x 1 x 7.5cm.
2 ¼in or ½cm long spacers with ⅛in dia or similar screws to suit.

RESISTORS: (½W or ¼W, preferably 5pc)
4 820k; 4 330k; 2 82k; 2 47k; 2 10k; 4 4.7k; 4 3.3k; 1 1.2k ohm ½W.
2 1M preset pots (optional, see text).

CAPACITORS
1 220uF 25VW electrolytic.
9 0.1uF 100V min polyester.
1 .01uF 100V min polyester.

PHASE CHANGE MODULE

1 Piece of Veroboard, 9 tracks, 37mm x 67mm.
1 Mounting bracket, scrap aluminium, 2-⅝in long.
2 Transistors, BC108, BC548, PC208, &c.
RESISTORS (½W or ¼W, 5pc)
2 1.5M; 2 820k; 2 330k; 4 5.6k; 1 2.2k.
CAPACITORS
1 22ouF 25VW electrolytic.
4 0.47uF 100V polyester.

Assembly of the unit should be a simple matter, aided by the diagrams. Two figure-8 shielded pairs need to be attached, which run back to the Mode switch in the space between the pot mounting bracket and the front panel. One pair conveys signal to the unit, the other from the unit back ultimately to the rear channel amplifiers. The remaining leads are the positive 21V lead to the main filter bank and the earth lead back to the lug on the preamp-tone control module.

Placement of the Stereo-24 Adaptor is fortunately not critical and we were able to locate it in the space behind the Hi-Lo filter switches.

To mount the unit, we made up a small angle bracket which was secured to the adaptor, on the copper pattern side, but stood off by ¼in spacers. This was secured to the floor of the chassis with countersunk screws, with the edge of the board just clear of the metal. The potentiometers face outwards although, as we have already mentioned, they are not strictly necessary in this application.

One point about the pots: they are mounted in a mirror-image configuration and rotate in opposite directions for the same function. For full on, both wipers should be turned towards the centre of the wiring board.

And there it is: with the Stereo-24 Adaptor built and installed, you should be able to synthesise four channel sound to your heart's content from existing recordings, whether disc or stereo tape. And you will also be able to cope reasonably well with matrixed quadraphonic discs.

Two other modules remain to be discussed, one to change the phase of rear channel signals being fed into the amplifier via the Ext-4 input, the other a decoder expressly for SQ matrix quadraphonic discs. The latter will be described in detail next month, being virtually a project in its own right. While its immediate role relates to the Playmaster 140, it could in fact be used to advantage with any quadraphonic system that you might be putting together.

(Continued on Page 117)

Inductance comparison meter for coil diagnosis

Diagnosing shorted turns and leakage conditions in coil windings is a tricky business from the service technician's point of view. As the substitution method is usually employed, this can lead to lost time and money should the original diagnosis prove incorrect. This simple instrument provides a rapid and reliable method for diagnosing the condition of suspect coil windings such as TV line output transformers, deflection yokes, power chokes, and the rotor and stator windings on automobile alternators.

by J. de C. GRANDIN

This instrument was originally developed to help solve problems in the automotive field with which the author is closely associated. These problems are related to the stator and rotor windings of automotive alternators. When these windings are suspected of having faults such as leakage between phases, or shorted turns, the usual procedure is to dismantle the alternator, replace the suspect windings, and then reassemble and test the alternator. This procedure is time consuming and involves a lot of unnecessary expense if the original windings were not at fault.

A parallel situation exists in the television servicing field with regard to vertical and horizontal output transformers. Here again, suspect components can be replaced quite unnecessarily. For the industrial electrician, leakage within windings, or shorted turns, in units such as motors, generators, and even the humble ballast choke of fluorescent lamps, can be difficult to locate. A positive check on the condition of these windings requires that that the substitution method be used. An incorrect diagnosis can therefore lead to lost time and money.

Shorted turn testers have previously been described in "Electronics Australia," and these are quite useful in their particular applications. However, the author has long felt the need for an instrument that could cover as wide a range of inductances as possible; from the inductance represented by a ferrite rod aerial to that of a power choke of several henries. The instrument to be described will do just this, and, to the author's knowledge, is the only one to do so at a reasonable cost.

As can be appreciated, the design problems were considerable. Several methods were tried but failed to meet the wide inductance range desired. Testing an inductance for leakage, or for shorted turns, means that the efficiency, or "Q" needs to be determined against some known standard. Therefore, very early in the developmental stages, the method of comparing a suspect item against a known good item was used. For the serviceman, or electrician, this is no problem, as spare parts are normally carried.

If the suspect coil or transformer is good, the effect of connecting it into the oscillator circuit is merely to change the frequency of oscillation. But if it has a shorted turn, or has leakage within the windings, the loading reflected is sufficient to cause the oscillator to drop out, or at least to drop significantly in output.

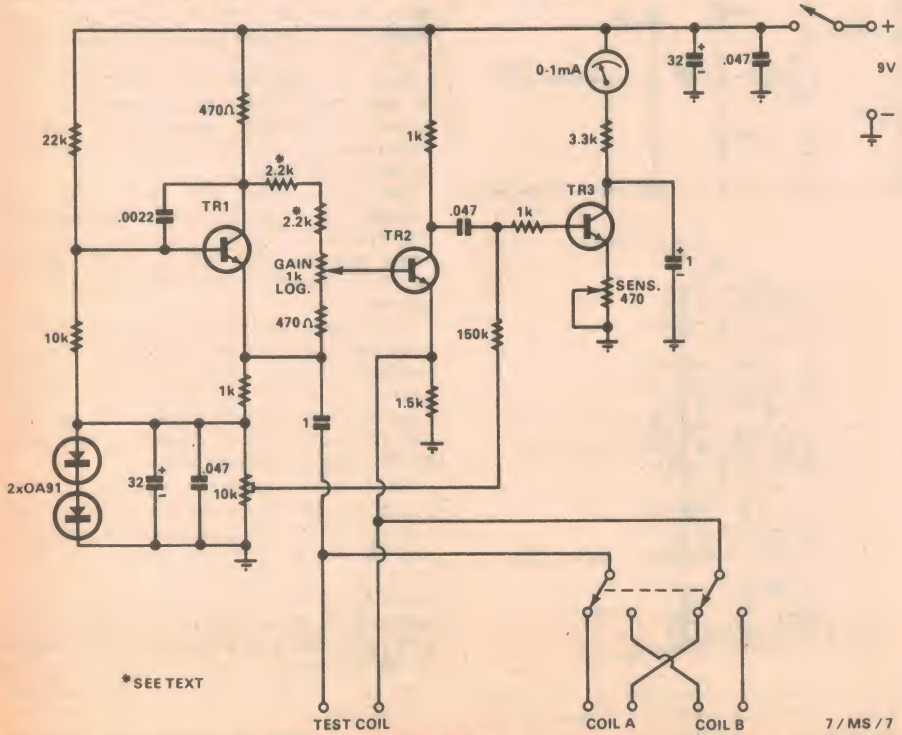
With such a wide range of inductance values likely to be encountered, it is necessary to change the operating frequency of the instrument in order to obtain a useful degree of reactance. In this instrument, the change in frequency is automatic and varies from approximately 400 to 4,000Hz. Pulse techniques were tried at first, but it was found that undesirable ringing effects gave misleading results.

Oscillators of many forms were also tried, but became far too complicated, (from a switching standpoint) to cover the required inductance range. Another serious problem was the necessity to cope with both low "Q" (eg the rotor winding of an alternator) and high "Q" (eg a radio IF transformer). The oscillator circuits tested would either not operate on low "Q" items, or would suddenly jump into oscillation in an unstable fashion. After a considerable amount of work, the design presented below was finally evolved.

The circuit of the Inductive Comparator consists, basically, of a transistor oscillator followed by an indicator stage which monitors the activity of the oscillator. A study of the circuit diagram will reveal that an oscillator of rather unusual design has been employed. Transistors TR1 and TR2 form an emitter coupled multivibrator, the gain of which is controlled by a 1k potentiometer forming part of the resistor network connected between the emitter and the base of TR1. This stage is followed by a detector circuit (TR3) and the indicator circuit which employs a 0-1mA meter.

Transistor TR1 is forward biassed by the 22k and 10k resistors connected to its base, whilst the 0.0022uF capacitor, connected between the base and collector of TR2, provides a negative feedback path which prevents the system from "taking off" at frequencies extending up into the RF spectrum. The two 2.2k resistors shown asterisked in the circuit diagram may need to be adjusted in value to ensure that the circuit ceases oscillation at minimum gain control setting. The circuit will commence oscillating as the gain control is turned towards maximum, even with the coil A and coil B terminal leads shorted out. The natural frequency under these conditions will be approximately 3kHz.

Note that all inductances tested are placed in series with a 1uF plastic capacitor which is coupled into low impedance points in the circuit. The detector system derives



The circuit diagram of the Inductive Comparator.

The completed instrument is simple to operate.

its input from the collector of TR2, resulting in low load conditions on the oscillator. For the experimenter, the oscillator can provide a stable source of audio frequencies ranging from approximately 400 to 4,000Hz, depending upon the inductance used.

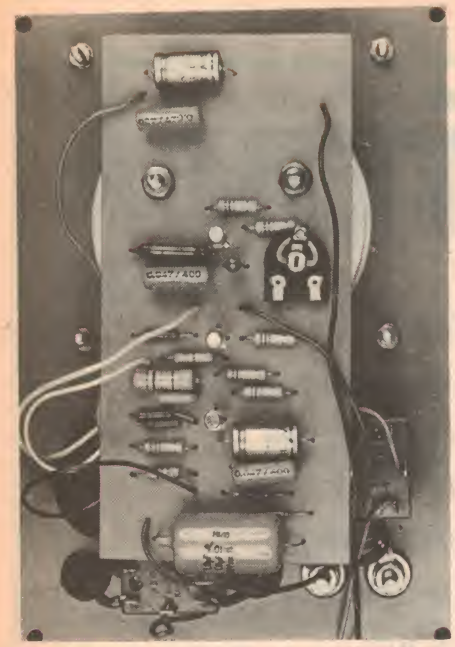
The two OA91 diodes, together with their by-pass capacitors, provide stabilised forward bias for the detector TR3. The 10k pre-set potentiometer is set to give a current reading of approximately 0.18mA with the sensitivity and gain controls at maximum and minimum settings respectively. The diodes also provide some degree of temperature compensation for TR3.

Under the conditions of forward current through the diodes, and by reason of their knee curvature, they jointly develop over 1V across the 10k pot. If any other diodes are contemplated for this role, they must satisfy this requirement.

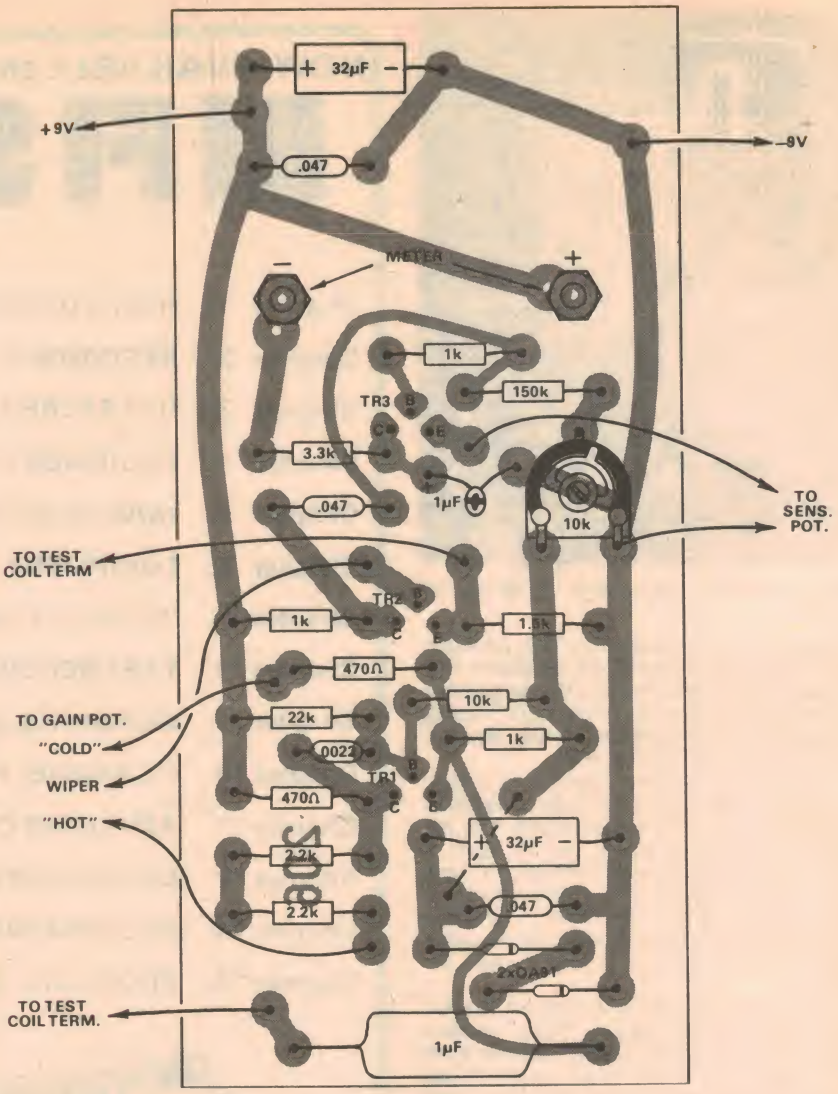
The 0.18mA standing current has been selected for two reasons. Firstly, it places TR3 in a sensitive operating condition and, secondly, the obvious current indication on the meter provides a reminder that the instrument is switched on. In addition, the standing current value can be used to indicate the condition of the battery due to the fact that a decrease in the voltage of the battery results in a corresponding decrease in the value of the standing current. Current drain from the battery is approximately 5mA.

The significance of the scale readings on the meter should be pointed out at this stage. If the sensitivity control is set to maximum and the gain control is adjusted for a reading of 0.4mA, a small variation in the "Q" of the coils being compared will result in a large variation in oscillator ouput. With the gain control at this setting the oscillator is at a low activity level; possibly close to dropping out of oscillation altogether. As a result, it is most sensitive to any changes in its associated circuitry.

On the other hand, if the gain control is advanced so that the meter reads, for example, 0.8mA, then the same variation in the "Q" of the coils being compared will result in a smaller variation in oscillator output, than for the previous case. Thus, the output and sensitivity control enable the instrument to be adjusted so that it can be effectively used to test both high "Q" and



The internal wiring of the instrument is shown above. The component diagram at right shows the full size pattern of the printed board.



low "Q" inductances.

Items such as TV yokes can be compared by connecting their respective leads to the coil A and coil B terminals, and setting the sensitivity control to a maximum. The oscillator gain control is set to give a reading of about 0.8mA. Power transformers, on the other hand, can be compared by connecting the appropriate filament windings on each transformer to the coil A and coil B terminals. As indicated earlier, less sensitivity is required to compensate for the lower "Q" of iron-cored transformers.

When comparing ferrite rod aerials, the windings that are normally tuned by a variable capacitor are connected to the coil A and coil B terminal leads, and the sensitivity and gain controls are set to maximum and mid-scale values respectively. The effect of a shorted turn may be quickly demonstrated by slipping a closed turn of wire over a known good ferrite aerial rod.

A different technique is required for high value inductances such as power chokes. In this case, it is necessary to connect an inductance across the "test coil" terminals to allow the oscillator to function at maximum sensitivity. The power chokes to be compared are then connected to the coil A and coil B terminal leads. The primary winding of an ignition coil was used by the author as a test coil. This method is obviously one of "loading" the test coil with a high value of parallel inductance to enable variations in "Q" between coil A and coil B to become evident.

The stator windings of an alternator can be compared without the use of a test coil, however the rotor windings will require a test coil as detailed above.

As can be seen from the photograph, the prototype was built in a 19 x 13.5 x 7.5 cm instrument case. The meter is mounted on the front panel, along with the on / off switch, the sensitivity and gain controls, the test coil terminals, and the coil A / coil B switch. The coil A and coil B leads are run through two rubber grommets mounted on the front panel on either side of the coil A / coil B switch.

The rest of the components are mounted on a 14.3 x 6.7 cm printed wiring board which is bolted onto the two meter terminals. The front panel is fastened to the instrument case by means of four self-tapping screws.

A battery clamp should be made from 16SWG aluminium to secure the Eveready 2362 to the back panel of the instrument case.

To assist those readers who may wish to construct this instrument, Ferrier Electrical Instruments of Penrose Street, Lane Cove 2066, advise that they are prepared to supply the following items: 0-1mA meter, the printed wiring board, the metal case, and the front panel. Other items such as resistors, capacitors, knobs, terminals etc will have to be purchased separately by the constructor.

LIST OF COMPONENT PARTS

1 instrument case, 19 x 13.5 x 7.5cm
1 front panel
1 metal handle
1 moving coil meter movement, 1mA sensitivity
1 SPST toggle switch
1 DPDT toggle switch
4 alligator clips
2 screw terminals
1 printed wiring board, 14.3 x 6.7cm
3 BC108 or similar silicon NPN transistors
2 OA91 diodes
1 Eveready 2362 9V battery
2 knobs

RESISTORS
(½W, 5pc tolerance)
2 x 470 ohm, 3 x 1k, 2 x 2.2k, 1 x 1.5k, 1 x 3.3k, 1 x 10k, 1 x 22k, 1 x 150k, 1 x 1k (log) potentiometer, 1 x 470 (lin) potentiometer, 1 x 10k preset potentiometer.

CAPACITORS
1 x 0.0022uF 100VW metallised polyester
3 x 0.047uF 100VW metallised polyester
1 x 1uF 100VW metallised polyester
2 x 32uF 25VW electrolytic
1 x 1uF 35VW tantalum

MISCELLANEOUS
Scrap aluminium for battery clamp, solder, hook-up wire, screws, nuts, washers, rubber grommets.
Note: resistor wattage ratings and capacitor voltage ratings are those used in the prototype. Components with higher ratings may generally be used provided they are physically compatible. Components with lower ratings may also be used in some cases, providing the ratings are not exceeded.

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LSI digital VOM: addenda

Our Digital Volt-Ohm Meter project of January-February 1973 was a very successful one, with many hundreds of units being built successfully. A few constructors have encountered troubles, however, and for these the following comments may be helpful.

To begin with, it would perhaps be wise to draw attention to the small number of actual circuit errors and notes which have been published for this project in the past year.

Firstly, the board wiring diagram on page 37 of the February article showed the -12V regulator zener (AN759) with reversed polarity.

On the main circuit diagram in the January issue, the polarity markings of the inputs of the 740 input buffer were reversed. Also the driver transistor for FET switch F1 was shown as a 2N2638A, when it is of course a 2N3638A. The parts list on page 35 should also list a total of 5 2N3638A devices.

Also McMurdo Australia have advised that the correct part number of their 24-pin IC socket to suit the 3814 device is 2150-23-02.

Now for those problems which a small number of readers have encountered. Possibly the most common of these has been a complaint of excessive "bobble," or change in reading of the least significant digit of the readout display. In one or two particularly bad cases, the bobble was sufficiently great to affect the next most significant digit as well.

Generally, "bobble" is due to AC ripple, and is caused either by excessive pickup of AC hum by the meter input circuitry, or by a reduction in the normal ability of the integrating circuitry to reject mains ripple.

In some instruments with this trouble, the builders have found that they had allowed the AC mains lead running to the power switch to pass very close to the analog input circuitry on the board, and that the bobble could be cured — or at least reduced considerably — by simply re-routing the mains lead further away.

Where this does not appear to be the trouble, or where there still remains an annoying residual bobble, it is likely that the integrating circuitry is not adequately rejecting mains ripple. The mains rejection depends upon the period of sampling the input voltage being exactly 20 milliseconds long, so that the average value of any ripple component should be zero. As the sampling period is derived from the clock generator, by dividing by 10,000, this means that in theory full mains rejection can only take place if the clock generator runs at exactly 500kHz.

In practice it is not quite as critical as this might sound; a drift in clock frequency of up to 20kHz or so either way doesn't seem to have a drastic effect. However if component variations cause the clock frequency to be much further away than this, the sensitivity to mains ripple certainly rises, and bobble can become evident.

The cure here is obviously to move the clock frequency back into tolerance, by altering the value of one or both of the timing capacitors. These are the two capacitors associated with the 9602 IC, shown on the circuit as 390pF.

The easiest way would be to monitor the clock frequency with a digital counter, or failing this, with a small AM radio tuned to the second harmonic. Simply adjust the values of the timing capacitors until the frequency falls as close as possible to 500 kHz.

If you have neither a counter nor a small AM radio conveniently available, try altering the value of one capacitor and note the effect on the bobble. If it improves, keep changing the capacitor value in the same direction until no further improvement is needed; if it gets worse, reverse direction.

Another problem encountered by a few constructors has been "sticking" or "locking" of the display. In most cases this has shown up as an apparent "unwillingness" to follow increasing voltages, when they enter the over-range region (ie,

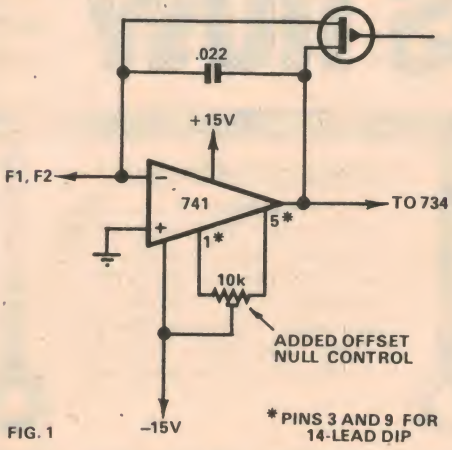

FIG. 1

increase from 9.999V to 10.000V). Sometimes this has also been accompanied by a failure to indicate an overflow. In one or two other cases, the display has simply appeared to "lock" for short periods of time and refuse to alter.

One of the readers who struck this trouble is Mr P. D. Webb of Zillmere, Queensland, who wrote to tell us that he had also found a cure. After initially trying another 3814 device, without success, Mr Webb deduced that the trouble was most likely associated with the "transfer" signal fed to the 3814 from the 734 zero-crossing detector. He reasoned that if there was no effective transfer command, the 3814 would not update its stored count, and this would explain the "sticking". The trick was to find out what could be happening to disturb the transfer signal . . .

Further thought led Mr Webb to suspect that the trouble may be due to zero offset in either the 734 or the 741 integrator — particularly offset in the direction not easily compensated by the current controlled by the DC zero pot. To check this he tried fitting a zero offset control to the 741, choosing this IC mainly because it was easier to get at. As this cured the problem, he feels that this substantiates his theory, and I am inclined to agree.

For those who would like to add this extra zero offset control, the circuit details are shown in Fig 1.

Mr Webb reports that he adjusted the additional offset control by turning the instrument to an "ohms" range with the input open circuited, and then adjusting the new control until the display "unlocks". The DC zero control naturally needs to be reset following this operation, by the procedure originally given.

The final trouble reported by some readers has been faulty operation of the leading zero blanking. Generally this has been apparent as a failure of the blanking when the LEDwith the most significant digit of the reading has a 6, 8, 9 or 0 in addition to the decimal point.

It would appear that this fault is basically one of insufficient conduction in the 2N3638A driving the DP input of the 3814. The likely cause is the combination of a minimum-gain 2N3638A, together with high saturation voltage drop in one or more of the 2N3641 (or AY1103) digit selector transistors, and / or a high voltage drop in the decimal point segments of the LED displays.

The higher the saturation voltage of the digit selector transistors, the higher will rise the cathode voltage of the LEDs, particularly when the current rises due to the number of segments lit. This together with the voltage drop of the decimal point segment itself will tend to reduce the bias voltage available for the 2N3638A, so that if the latter is at the low gain end of its spread range, it may not conduct sufficiently to provide the necessary drive for the 3814.

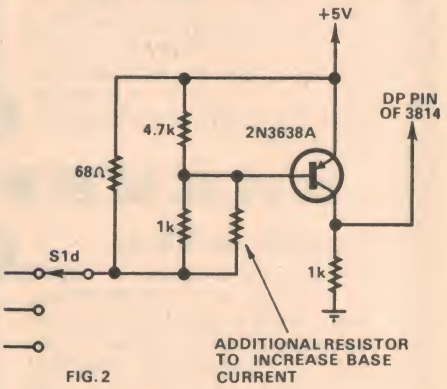

FIG. 2

The easiest way to correct the situation is to fit a second resistor across the 1k resistor connecting the base of the 2N3638A to the rotor of switch Sld, to increase the base current. Mr Webb of Queensland tried this, and found that in his case a second 1k resistor across the first was necessary to completely cure the trouble.

In other instruments a larger value may be quite adequate, while there may be cases in which a smaller value might be required. The details are shown in Fig 2, to obviate possible confusion.

These are the only troubles which have been reported to date by builders of the DVOM project, together with suggestions regarding their cure. I would like to thank those readers, including Mr Webb, who wrote regarding the project, for their time and courtesy. Without this sort of feedback, it is difficult for us to be of much help. (J.R.)

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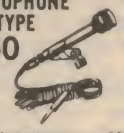

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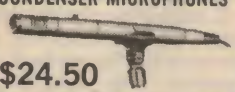

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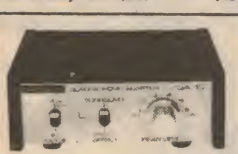

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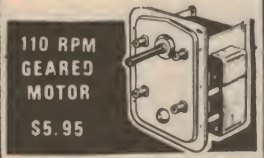

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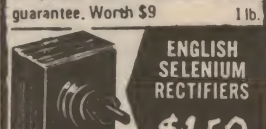

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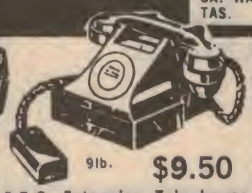

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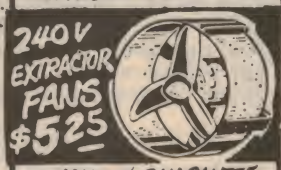

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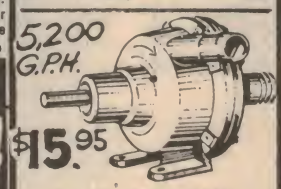

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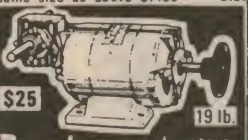

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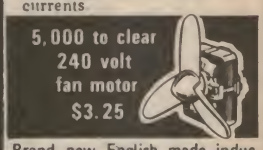

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6V to 12V Converter

by LEO SIMPSON

Here is an ingenious DC-DC converter circuit which doubles its battery input voltage and does not require any diodes to rectify its output. It can be used to power 12V car radios and stereo cartridge players from a 6V battery.

While the number of cars with 6V batteries is now a minority and confined to Volkswagens five years old or more, we still have readers who write for just such an inverter circuit. And we felt the circuit was unusual enough to be of general interest. Readers will undoubtedly find other applications for the idea.

We can't claim that the novel circuit used is original. It is of Japanese origin, and a local radio and television serviceman, Peter Broughton, of 99 Sussex Street, Sydney, referred us to it. At our request Ferguson Transformers Pty Ltd provided the prototype transformer and we modified the circuit to suit locally available transistors.

Refer now to the simplified circuit in Fig 1. It shows the converter as consisting basically of two power transistors and a transformer with two centre-tapped windings.

One of the transformer windings has each "leg" connected to a transistor collector while the other winding has each "leg" connected to a transistor base. The transistor emitters are connected together and thence to the minus 6V supply rail from the battery. The centre-tap of the collector winding connects to the positive rail (0V) from the battery while the centre-tap of the base winding becomes the negative output lead (minus 12V). Thus the 12V output is taken from between the two centre-tap connections of the transformer windings.

The mode of operation is as follows: Consider that Tr1 and Tr2 are functioning as a typical transformer coupled multivibrator with both transistors switching alternately between "cut-off" and "saturation." Now consider Tr1 "on" and Tr2 "off." This place minus 6V directly across the Tr1 collector's half winding, so that plus 6V appears across the other half, by transformer action. In total, 12V or double the battery voltage appears across the whole collector winding.

For the purpose of our explanation, we have neglected the small "saturation" voltage from collector to emitter of Tr1 and we will also neglect the base-emitter forward-bias voltages of the transistors.

Now, at the same time as the conduction of Tr1 places 12V across the collector winding, transformer action causes slightly more than 12V to appear across the base winding in the opposite direction, so that the base of Tr2 is minus 12V (approx) with respect to the minus 6V established at the other end by the base of Tr1 (conducting). This means that the centre tap of the base winding is now minus 12V with respect to the 0V line.

When the transistors switch over so that Tr2 conducts; the same process occurs so that the base of Tr1 becomes minus 18V with respect to 0V and again the centre-tap is minus 12V with respect to 0V. This means that while ever the transistors are switching, the centre tap of the base winding is maintained at minus 12V with respect to the positive battery line (0V).

Thus, the transformer's output does not require any rectification. The base current is supplied via the load connected between the two centre-tap connections. Indeed, under normal conditions, the inverter will not function without a load. The transformer's slight "step-up" from collector winding to base winding is to compensate for losses in the transformer and in the transistors.

Referring now to the complete circuit diagram, readers will note that it contains additional components: two silicon diodes and two large electrolytic capacitors. The transistors are the easily available silicon NPN power type 2N3055. The purpose of the capacitors is to provide filtering of the input and output lines so that "switching hash" is heavily attenuated.

Two important functions are served by the diodes connected in series with each transistor base. First, they prevent damage to the transistors which is possible because of the reverse voltage applied to the transistor base (when the transistor is "cut-off") with respect to its emitter. Second, the diodes prevent spurious operation of the converter which is possible when no load is connected — the unit may then run without any apparent base current supply. What apparently happens is that leakage via the reverse-biased transistor is sufficient to enable the other transistor to conduct.

As the circuit stands, with diodes incorporated, it needs a load before it will operate. This is a desirable feature as it means no power is drawn from the battery unless it needs to be. It also means that the unit can be wired into circuit and does not require a power switch — the power switch on the car radio or cartridge player it powers is sufficient.

Minimum load current for reliable operation of the circuit is of the order of 100 milliamps. It may be used at lower currents with somewhat less reliable starting and running.

The prototype transformer is type number TRD 277 made by Ferguson Transformers Pty Ltd. With a 6V input, maximum output current at 12V is about 750mA. At this load, input current is about 1.8A. Heavier loads can be connected but the output voltage drops somewhat and losses in the small transformer core become excessive.

We have incorporated a fuse in the circuit to limit the input current to less than 3 amps. This is to protect the diodes, which are rated at 1 amp each but will in fact withstand more than this for a short period. The fuse also protects the base-emitter junctions of the transistors which are rated at 4 amps. In fact, the ratings off all components in the circuit will not be exceeded provided that the load current does not exceed more than about 800mA.

Note that one side of the output is connected to chassis (of the motor car). As shown, the circuit is suitable for use with cars having a "positive earth" electrical

At right is the prototype converter housed in a standard diecast box. If necessary it could be crammed into a smaller box.

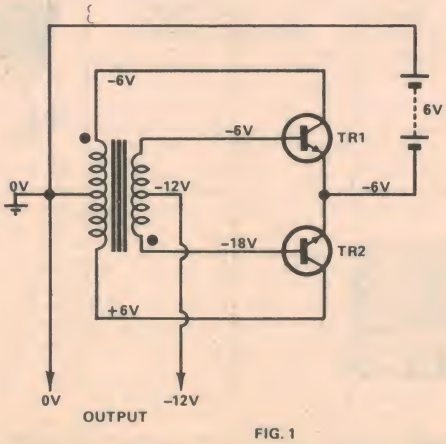


FIG. 1

A simplified circuit of the converter.

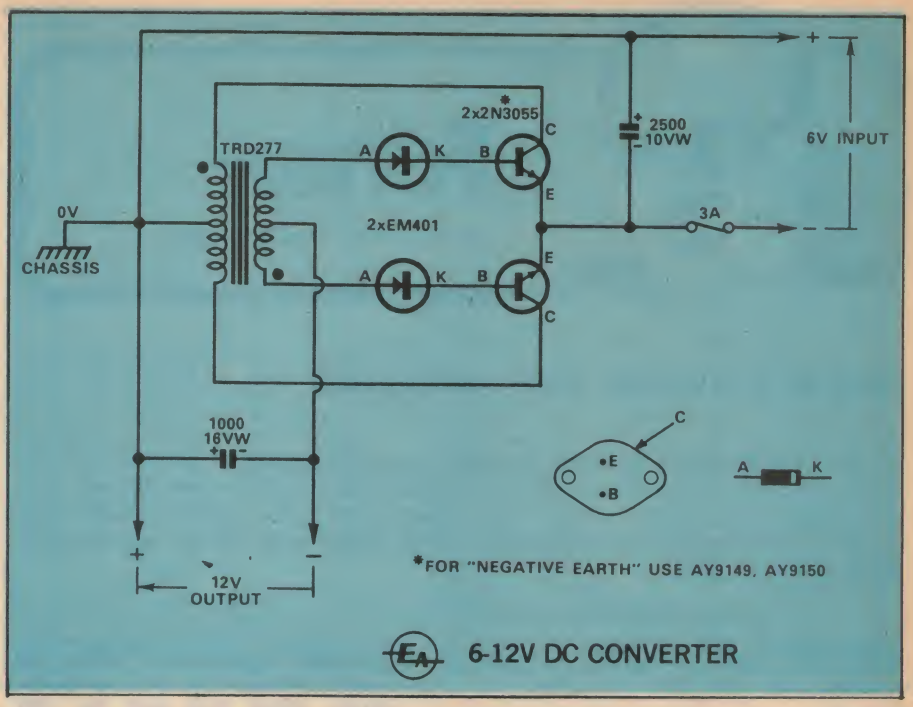
system. At the same time, it must be used with car radios or stereo tape players which also have a "positive earth" chassis.

If the unit is required to operate in a vehicle with a "negative earth" electrical system, the battery polarity is reversed so that the negative electrode connects to chassis. At the same time, several circuit changes must be made. First, the polarity of the diodes and electrolytic capacitors is reversed. Second, PNP transistors are substituted. Suitable PNP silicon power transistors which are reasonably priced are the Fairchild AY9149 or AY9150. These are very robust transistors which have similar ratings to the NPN 2N3055.

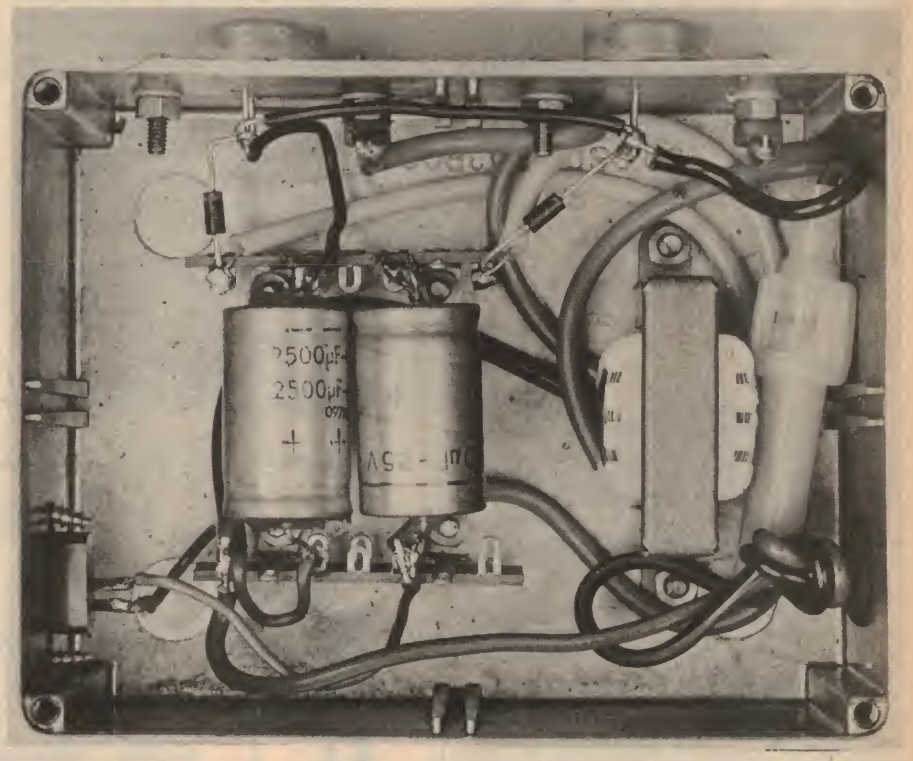
Now a few words on the construction. We housed our unit in a diecast case measuring 120 x 95 x 55mm which are available at quite an attractive price. There is no reason, however, why it cannot be housed in smaller case, provided all components fit. Heatsink requirements of the transistors are very modest and the diecast case is more than adequate for the purpose. The main source of heat in the circuit is the transformer, and this does not become overly warm at the maximum recommended load current.

PARTS LIST

1 diecast box, 120 x 95 x 55mm.
1 inverter transformer, Ferguson TRD 277 or similar.
2 silicon NPN power transistors, 2N3055 (for "positive earth" version).
2 silicon PNP power transistors, AY9149 or AY9150 (for "negative earth" version).
2 silicon power diodes, EM401 or equivalent.
1 1000uF / 10VW electrolytic.
1 2500uF / 16VW electrolytic.
1 in-line fuseholder.
1 3A fuse.
1 2-pin polarised socket and plug.
2 7-way tagstrips.
MISCELLANEOUS
Mica washers and plastic bushes to mount transistors, solder lugs, hook-up wire, screws, nuts, lockwashers, solder.
NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used providing they are physically compatible. Components with lower ratings may also be used in some cases, providing the ratings are not exceeded.



Above is the complete converter circuit while below is the layout inside the case.



Use mica washers and plastic bushes to mount the transistors so that they are insulated from the case. Since the transistors each dissipate relatively small amounts of power, it is really not necessary to use silicone jelly to improve heat transfer.

Wiring layout is not at all critical and provided solder joints are made properly, the circuit shoud work without any trouble. Remember that a load must be connected otherwise it will not operate. If it does not operate at first try, swap over the orange leads to the collectors of the transistors.

We found that when the unit is used to power a typical dash-mounting car radio, hash generated by the inverter was not a problem — there was only a very slight buzz from the speaker even when the volume control was at maximum setting. However, if it is used to power a radio or stereo tape player with inadequate internal interference suppression components, audible hash and whine could be a problem.

In this situation, a worthwhile reduction in "hash" and whine can be obtained by connecting an LC network to filter the output of the converter. It consists of an inductor in series with the "hot" output lead and then a shunt capacitor across the output leads of about 500uF, rated at 16V or more.

A suitable inductor can be made as follows: Start by winding a layer or two of plastic insulation tape on a 50mm length of 10mm (approx) ferrite rod. If a full length rod has been purchased it can be cut by filing a groove around the circumference of the rod and then snapping it as if it were glass.

Close wind a layer of 22 B&S enamelled copper wire over the insulation tape, and finally wind insulation tape tightly over the wire to anchor it all. Then tin the ends of the wire prior to soldering.

We used an in-line type of fuseholder but there is no reason why a panel-mounting type cannot be used.

While the primary use of the circuit is to obtain 12V from a 6V battery to run a car radio or tape player, we have no doubt that readers will come up with other applications. It can be used at input voltages of 12V, but losses are higher and heatsinking of the transistors becomes more stringent.

Forum

Conducted by Neville Williams

Further din about DIN connectors

As one might have expected, the item in our November "Forum", on the subject of DIN connectors, evoked a reaction from quite a few readers. Unfortunately, and again in line with expectations, the reactions have only mirrored the situation we described. It has been, and still is, one of considerable confusion.

To clarify the point, we quote from two letters, one from a reader in South Australia, the other from Tasmania.

Dear Sir,

It was with a good deal of disappointment that I read in "Forum (E.A. Nov '73) that a confused situation still exists over the use of DIN connectors. I had hoped that the situation had been rationalised and that the industry had adopted a standard.

On the advice of your magazine (E.A. May '69, page 97) I have adopted the following standard:

pin 1 left channel input
pin 4 right channel input
pin 2 common shield
pin 3 left channel output
pin 5 right channel output
All connecting cords have:
pin 1 to pin 3
pin 4 to pin 5
pin 3 to pin 1
pin 5 to pin 4
i.e. inputs to outputs

While this looks complicated on paper, it is surely logical that inputs should feed outputs and that inputs and outputs should be separated by the common shield.

This, with some conspicuous exceptions seems to be the standard which you have adopted in your projects which use DIN connectors, of the 5-pin variety.

This standard has given me greater flexibility for a "systems" approach to my audio set-up, has meant that only one type of cord need be used for all applications, and does not need a great screed of "which pins for which application" to be carted around with me. With a little experience all the relevant information can be carried in the head.

I would like to make the following comments.

(a) Please let us know what standard you will be adopting and then stick to it.

(b) If at all possible drop the use of 3-pin DIN connectors. At least one supplier, as a matter of policy is supplying 5-pin DIN connectors even when 3-pin DIN connectors are ordered (see Kitsets' Catalogue P17; Note alongside Type DS3).

(c) The mixed use of 3-pin and 5-pin connectors in the two preamp projects in your November '73 issue seems hard to justify. The different wiring of the input sockets of both preamps seems also rather inconsistent. I realise that there is a 'standard' which governs disc players which says that the DIN connector should be wired as shown for the disc preamp, and that a tape recorder should be wired as shown for the disc preamp, but surely there is no basic difference in the uses of the two preamps.

B.B. (Goolwa, SA)

The "advice" which B.B. says he adopted (E.A. May '69, page 97) was the item which we referred to in our November article, and one that had been reprinted from an overseas source. We remarked thus upon its ambiguity:

"How do you interpret this? Is the plug on the end of a cord from a microphone, or a radio tuner, to be regarded as performing an output function from the source or an input function to the device?

"It may seem obvious enough to the writer or supporter of the scheme but it certainly isn't obvious to the reader!"

Whether B.B. was sensitive at the time to the ambiguity is not evident but, presumably, he interpreted it in a way which brought his connections into line with what is now commonly used for tape recorders. (Our diagram, November '73, page 65).

He has apparently used this for all his equipment with crossed-over connections as necessary. By so doing, he has adopted much the same position as the member of our staff mentioned on page 67 of the same issue.

But he has also stepped out of line with what is now the most widely accepted practice, and the connections to his amplifiers will be a mirror image of commercial units.

He has solved his own problems — but only for as long as all his amplifiers are home-made!

What standards has E.A. adopted in the past?

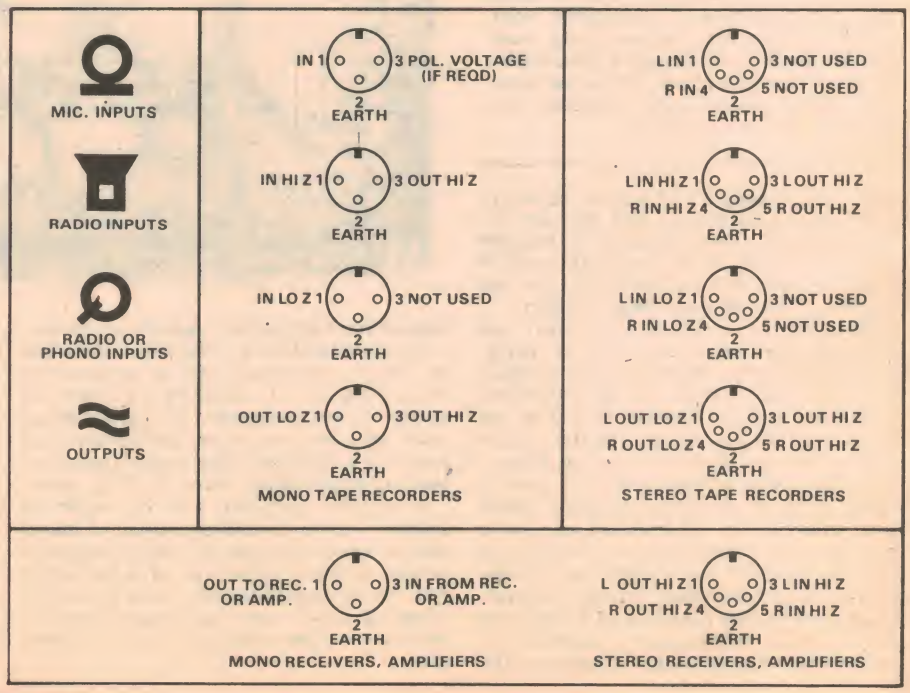
It would be most gratifying if we could publish a diagram and say "that's it!"

But, in practice, we also have been the victims of past confusion and it would be idle to pretend otherwise. With so many different people, over the years, working on audio projects, there have been different interpretations of "standards" and differing degrees of concern about them, anyway.

A strong motivation for our article in the November issue was the need to make firm decisions in respect to the Playmaster 140 quadraphonic amplifier. While appreciating the logic of other viewpoints, we could not escape the conviction that the new Playmaster should follow the conventions adopted for current commercial amplifiers. On this basis, there would be a reasonable chance that pickups and tape decks would plug straight in.

And having made this decision, it will be logical to stick to it in the future: we will try to stay with the most commonly accepted commercial practice.

The problem, of course, is to assess what is "the most commonly accepted commercial practice". It seems clear enough



for the two examples shown in our November issue, but this may not be the case for some of the less common applications.

As a matter of interest, a recent issue of our associate English journal "Practical Wireless" carried a small card inset setting out connections for 3-pin and 5-pin DIN plugs and sockets. We assume that it is the result of an on-the-spot survey and we reproduce the essential information as a matter of interest. You can have fun verifying it, or pulling it to pieces!

But what about 3-pin and 5-pin connectors?

One obvious classification is to limit 3-pin connectors to mono equipment and 5-pin connectors to stereo equipment, as per the "Practical Wireless" chart. This has an historical basis but it is certainly not universally observed.

It would seem that they are often intermixed to reduce the chance of plugging a this into a that or, more simply, to create an obvious difference pattern in a line of otherwise identical sockets. We had both thoughts in mind in choosing the sequence of sockets on the back of the 140 chassis.

As for the idea of marketing only 5-pin connectors, I can foresee some rather unhappy customers, because they are compatible only one way. What about the customer who has equipment fitted with a 3-pin socket, and who receives through the mail a 5-pin plug?

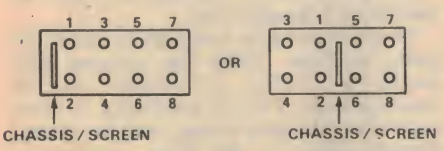
That's one letter. The other one reads as follows:

Dear Sir,

Your DIN din was very intriguing but there is one solution that seems to have been bypassed, unless there is an equally obvious flaw not apparent to me. The suggestion is to use the same system that higher voltage systems employ, namely female outputs and male inputs.

Brief thought shows that this could work in all circumstances providing dual output / input sockets are not attempted.

Perhaps to get as far away from the dreaded "din" as possible, and all the other "standard" plugs we suffer these days, a rectangular layout could be tried. For instance:



The second sketch provides a layout which gives pins 1-4 for low impedance and 5-8 for high impedance outputs or inputs. 4-pin plugs and sockets can still be used which are not interchangeable. Pins can be extended in number for multi connectors to mixers, for example, still using the same configuration.

Please tell me why not.

J.A. (Hobart, Tas)

I quote this letter because it illustrates so well how confusion breeds confusion.

Having been discouraged by the discrepancies and apparent lack of logic in pin numbering, J.A. suggests we introduce a new guideline: female connectors for output, male for input.

I see three immediate difficulties: (1) chassis mounting male DIN plugs are a rare commodity; (2) pin usage could still be confused; (3) it is common practice, and very convenient, to have some cables and connectors carrying both input and output signals.

Most likely, J.A.'s suggestion will go no further but it doesn't always work out that way. If a designer is sufficiently convinced that he has a better idea, and if he's in a position to put it into practice, yet another variant can, in fact, appear on the market.

So much for DIN connectors. When I read the second part of the letter, I really wondered whether J.A. was having me on, and I'm still not sure.

Either he is, or he's re-invented the wheel!

Anyone slightly grey around the temples couldn't possibly read his proposal for a rectangular connector without seeing it as a description of the wartime "Jones" plug. Maybe liberties were taken with the name but there seemed to be an endless array of rectangular connectors at the time, all of them credited to the same gentleman — if he was such!

More to the point, it was a standing joke that no one had ever discovered two different pieces of equipment for which the connections were the same!

In fact, Assistant Editor Phil Watson suggested that JONES was really an acronym standing for Jumble Of Numerous Efforts at Standardisation.

Please, not the Jones plug again — at least for audio!

Meanwhile one reaction to the dilemma may be emerging right under our noses. The current generation of Japanese equipments seem to be carrying an ever increasing array of pin jacks on their back panels — one for just about every signal circuit; and that means four-off in the case of quadraphonic. To connect this to that you simply need an armful of shielded double-ended cables, carrying the matching male pins.

The problems of the multi-pin connector are bypassed, even though the user may need a short course in electronics to work out the separate connections!

The other point is that, while separate pins, sockets and cables may be very cheap and practical in the various Asian factory complexes, they are anything but that when bought off the typical Australian gadget counter.

Ah well . . .!

Last but not least, I'd like to say something about the Australian Citizen Band, on and around 27.24MHz.

What do I mean: Australian Citizen Band? Any PMG inspector will tell you that there is no such band, either in name or frequency! There is an industrial band on which citizens, if they have a good enough reason, may receive permission and a licence to operate hand-held equipment — sorry "officially approved" hand-held equipment! There is no provision in this country for unrestricted, casual use of radio transmitting equipment and therefore no risk of the chaos that has developed around such equipment overseas!

When are we going to stop kidding ourselves? Sure, there is provision for orderly operation of approved equipment. But it is also a fact that hand-held "27-Meg" transceivers have been on sale, openly enough, cheaply enough, and in such numbers that they were just another kind of present for the kids during the past Christmas period.

If we are going to have a Citizen Band by default, we might as well drop the pretence, give it a name and make it decent right now!

The Serviceman

On Guitar Speakers etc

As a general rule I steer clear of home constructors' problems. While they can be mentally stimulating they can also take up a lot of time; time for which one can seldom charge at the normal rate. Nevertheless, one sometimes does become involved, and this is one such story.

It concerns a young guitar enthusiast and the strife he encountered when he tried to acquire a guitar amplifier. In an effort to keep down cost, and because he did not need one of the 100W super monsters which so many believe are necessary, he decided to build his own. This was long before I came on the scene, but the story came out bit by bit when he finally approached me.

In fact, he had only a smattering of electronics, but one of his mates was rather more experienced, and offered to help in any way possible. After much discussion as to performance requirements, particularly power, the facilities needed, and the available cash, it was decided to build the Playmaster 138 Guitar Amplifier, from the May 1973 issue.

So a kit was obtained and our young enthusiast, aided and encouraged by his mate, began assembling components on the printed boards. Apart from the customary problems caused by non-familiarity with colour codes and other methods of component marking, no real difficulties were encountered. His mate helped out with the colour codes and so on, checked the boards when they were completed and helped make the necessary interconnections between them. Finally he "scrounged" an audio generator and dummy load with which to test the set-up.

Apparently things went pretty smoothly at this stage, the amplifier met its specifications, and the young guitarist found himself one step closer to his ultimate goal. He already had the guitar, he now had the amplifier, and it remained only to provide a suitable speaker system.

For this, and acting on his mate's advice, he had purchased a 12in speaker, of local manufacture, specifically designed for bass guitar work, and rated to handle at least 20W when mounted in a suitable enclosure. The plan was that he would build the enclosure himself and, in fact, he had already purchased the timber and cut some of the panels.

It is easy to understand what happened next. Arriving home with the amplifier he realised that everything was at hand for a trial run; guitar, amplifier and speaker. To be sure, the speaker had no enclosure, nor even a simple baffle, and he knew that this would limit its bass response, but he was quite prepared to accept this. Sufficient, for the moment, that he make the system work.

So the speaker was fished from its box, set up on the table, and connected to the amplifier. The guitar was plugged into the amplifier, the latter switched on, and the volume advanced. Then he strummed a few chords. Alas for his hopes. Instead of beautiful music, all the spaker gave forth was a weak rasping sound, bearing little resemblance to the original.

This was where I came into the picture. He was convinced it was the speaker which was at fault and, since I happened to be more readily accessible than his mate at that particular time, he approached me to see if I could explain what was wrong with the speaker and, hopefully, do something about it.

He was right about the speaker. The suspension system appeared to be jammed hard, with the cone in its outermost position. I made a couple of attempts to free it, but to no avail. Nor could I determine why it was like it was.

From the experience of other guitarists, there are several classic causes of speaker damage. The most common one is that, in the commercial environment in which they are frequently used, they are subject to rather more abuse than is a hi-fi speaker in the home. The show must go on and, if they eventually succumb to the belting that is frequently dished out to them, well — a new speaker is part of the running costs for the show.

This situation is aggravated because many amplifier users — and this includes those with conventional domestic systems — are under the mistaken impression that the wattage rating of an amplifier is sufficient to protect a speaker from overload, provided the speaker rating is at least equal to the amplifier rating.

What they fail to appreciate is that the wattage rating of an amplifier is only the figure at or below which the distortion is at an acceptably low level; it is not the maximum power which the amplifier can deliver. In fact, an amplifier may be able to deliver two or more times its rated output (though grossly distorted) if it is driven hard enough; a situation which can severely stress a speaker, both thermally and mechanically.

Not so common, but just as real, are a couple of less obvious hazards. One involves the simple act of plugging the guitar into the amplifier. With some circuits this can produce a click in the speaker and, if the amplifier happens to be turned full on, this seemingly innocuous sound can become a mighty wallop as far as the speaker cone is concerned. Repeated treatment can have only one result.

Another possibility is a naked plug on a guitar cable, the cover often being broken or lost in the hurly burly of transportation. This can allow a finger to come in contact with the active circuit as the plug is inserted in the socket and, again, with the volume control turned up, can grossly overload the speaker.

I questioned the customer on all these possibilities. As far as the last two were concerned there seemed little evidence to support either one. In regard to straightout overload, he was less sure, and admitted that he had been anxious to see how much level it would produce and had "turned the wick up a bit". In addition, the speaker was without an enclosure, which is highly undesirable.

On the other hand, his story didn't seem to fit the classic overload pattern. While speakers don't like being overloaded they seldom fail as rapidly or as catastrophically as this one had — it appeared to have been faulty almost from the first cycle. In these circumstances, the possibility of the speaker being faulty as it was delivered could not be overlooked.

More important, from a practical point of view, was that the customer needed a good speaker as soon as he could get it. We discussed returning the faulty one to the maker and possibly claiming a repair under guarantee. However, this would have involved an interstate shipment which, in itself, would be both costly and time consuming. If, on top of that, the makers rejected the claim, the cost of the repair would have been quite high. This, added to the freight costs, and a delay of several week's finally made up the customer's mind. It would be more convenient to buy a new speaker now, and argue about the old one later.

Fortunately, I had some similar speakers on hand. Repairs to guitar amplifiers form a part of my run-of-the-mill jobs these days, and speakers run high on the list of casualties — for reasons I have just described.

So my customer finally left with a new speaker tucked under his arm, after having been warned not to feed any kind of a signal into it until it was safely mounted in its enclosure. He left the old speaker with me to handle as I thought best.

I wasn't quite sure how best to tackle this latter problem. While the simplest way would be return it straight to the manufacturer, I had a hankering to know just what had gone wrong. And the more I thought about it, the more convinced I became that it was not a simple case of overload, common though this situation is.

But I realised that I could prejudice any claim against the makers once I tampered with the speaker; I would have to hope that they would accept my word that I had not aggravated, or even created, the fault.

Nevertheless, I decided to take a chance. With a razor blade I cut away the hemispherical dust cover in the centre of the cone, thus revealing the inner pole piece and the inside of the voice coil former. The latter is made from what might best be described as thick aluminium foil.

Part of the trouble was immediately obvious. The aluminium former was badly torn, with a mutilated voice coil visible through it. But this tear was some ⅜in in front of the inner pole piece, with nothing to indicate what had caused it. At the same time, there was obviously something still jamming the voice coil in the annular gap,

holding the cone and suspension at the outer extremity.

Well, I thought, having gone this far I might just as well be hung for a sheep as a lamb. I put as many fingers as I could get under the outside of the cone, at the apex, and forced it up. While somewhat brutal, it did lift the coil former clear of the gap and, more important, revealed the real cause of the trouble.

It was a piece of metal roughly ½in long, and ⅛in wide and, as nearly as I could judge, about 1/32in thick. And, rather significantly I felt, it was slightly curved, with about the same order of curvature as the inner pole piece. It gave me the impression of being part of the pole piece casting which, due to a fault, had come adrift after assembly.

At that stage I rang the maker's local representative, whom I know reasonably well, and told him what I had found. He was a bit incredulous, but promised to call in and take a look at it some time in the next few days when he was in my district.

At the time of writing he has not been able to honour that promise, due to pressure of other business, so the answer to that part of the mystery may have to wait until another time.

A few days later the customer was back in the shop. He had assembled the enclosure and given the system another test, which had been much more successful than the first one. At least he now had reasonably clean signals and good volume.

But he wasn't completely happy. He felt there was still something wrong — though he had difficulty explaining it — and was concerned because he had planned to take part in some kind of a show the following evening. Was there any chance that I could clear up the problem in time?

When I pressed him for more details, it turned out that there were really two faults; a noisy volume control and ". . . a kind of crackley bong from the speaker whenever the amplifier is moved or jolted". I was intrigued by the expression "crackley bong", but it was an apt one as it turned out.

In more technical terms I concluded that some part of the amplifier was microphonic and that a little gentle prodding should soon reveal it. I suggested he bring the complete system in for me to check.

When we finally had it set up in the workshop I had to agree that his description of the symptoms had been quite accurate. I noted that the volume control was noisy, but concluded that this was a separate problem. Right now I was more intrigued by the general touchiness of the amplifier to mechanical vibration.

The first thing I did was to turn down the volume control; whereupon the touchiness vanished, thus establishing in which half of the amplifier we should look. This amplifier is made on two printed boards; a preamp board and a main amplifier board, with the volume control between them. It was obviously the preamp board which needed checking.

I opened the case and attacked the preamp board with the butt end of a screwdriver. I found I could tap the board almost anywhere and produce the crackle-cum-ringing sound which the customer had so expressively described. But what I could not do was pinpoint the trouble. I had expected that one of the components would show a marked sensitivity and, in fact, I was particularly suspicious of some low voltage ceramic capacitors, these devices sometimes exhibiting marked microphonic tendencies. As it turned out, the components seemed less sensitive than the board.

I also noticed another strange effect. When I tapped the board with my fingers, rather than the screwdriver handle, the effect was much worse.

The fact that it appeared to be the board which was sensitive suggested a possible dry joint or hairline crack in the copper pattern. To check this I lifted the board from the four metal spacers on which it was mounted and left it supported in mid air by the interconnecting cables.

Then I attacked the board and components again with the screwdriver handle — only to find that the noise had suddenly vanished. Then I tapped each component with my fingers — still no noise. But when I tapped the board with my fingers a loud hum told me I was on the track.

It did not take me long to confirm my suspicion; the base material of the board was leaky. Why, I don't know, but there was no denying the fact. This board was designed with the earthy copper pattern cut back from the mounting holes so that the board would be isolated from the metal case on which it was mounted, with the copper pattern earthed in a prescribed manner to avoid hum loops.

But, with the base material leaky, the copper pattern was being connected to the metal case via a moderate value resistance. And, whatever spurious effect this unwanted circuit caused, it was modified by any flexing of the board, which would change its resistance as the material was stressed, in much the same manner as does a strain gauge.

More important than the theory of the problem was what to do about it. The obviously correct thing was to strip the components from the faulty board and rebuild the circuit on a new board. The problem was time; there just wasn't enough to permit this.

Then I had an idea. I rummaged through my box of assorted spacers and fished out four ½in insulated taped ones. With these I was able to mount the board so that it was completely insulated from the case. Then I gave it another tap test. It came through with flying colours. Finally, a squirt of "Serviceman's Friend" into the volume control doused its crackles.

So I was able to send the customer on his way, happily confident that his outfit would give a good account of itself at the forthcoming gathering.

Which was fine on a short term basis. In fact, we were lucky, since the leakage did not appear to be bad enough to upset operation by reason of leakage between adjacent components. Nor have I any way of knowing whether the condition will remain as it is or deteriorate further, though I imagine the latter is quite likely.

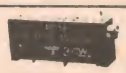
Which means only one thing; sooner or later the board will have to be changed. The customer fully appreciates this and I have no doubt that he can tackle it quite easily. For my part it was sufficient that I solved the immediate problem.

When he does rebuild the system, he has agreed to let me have the old board, in the hope that I may be able to find out why it is leaky. I have already made a few tentative inquiries around the trade, but those to whom I have spoken are either as mystified as I am, or have heard of such problems only at second or third hand. Perhaps some of my readers can help.

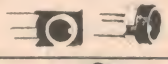
BOURNS Backbone Stocking Plan

We at Bourns Inc. make the world's largest range of adjustable and precision potentiometers and we recognise that in a market the size of Australia this can present certain availability problems. We have therefore devised the *BOURNS BACKBONE STOCKING PLAN.* We have created a nationwide distributor network and **normal** quantities of any value of all Bourns items listed should be available within seven to ten days. Of course there can be the odd delay but isn't it a help for designers and purchasing officers to know which types you can expect to obtain almost off the shelf?

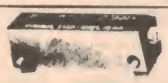
WIREWOUND — ADJUSTMENT POTENTIOMETERS

BOURNS	Description	Dimensions H x W x L	Terminals	Res. Tol. (%)	Power (Watt) at 70°C	Max. Temp. °C	Nom. Adj. Turns	Humidity Mil Spec	Standard Resistances Ω
 200	Low Cost TRIMPOT Potentiometer	.32 x .26 x 1.25	P	±10	0.5	105	25	Steady State	10-10K 20K & 25K 50K 100K
 224	High Temperature	.32 x .19 x 1.25	P	±5	1.0	175	22	Yes	10-10K 20K & 25K 50K 100K
 3007	Commercial E-Z-TRIM Potentiometer	.31 x .16 x .75	P	±10	1.0 at 40°C	125	20	Steady State	10-25K
 3067	Commercial E-Z-TRIM Potentiometer	.36 x .28 x 1.0	P	±10	0.5 at 25°C	85	15	No	50-20K

CERMET — ADJUSTMENT POTENTIOMETERS

 3006	Commercial TRIMPOT Potentiometer	.25 x .19 x .75	P	±10	0.75	125	15	Yes	10-2 Meg.
 3009	Commercial E-Z-TRIM Potentiometer	.35 x .19 x .75	P	±10	0.75 at 25°C	125	20	Yes	10-2 Meg.
 3282	Humidity Proof PALIRIUM Cermet Element	.20 x .375 x .375	L	±10	0.5 at 85°C	175	25	Yes	10-1 Meg.
 3329	High Performance PALIRIUM Cermet Element	.250 dia. x 180 .245 x .29 x .375	H W	±20	0.5 at 85°C	150	240°	Yes	10-1 Meg. 10-1 Meg.
 3389	Single-Turn Commercial	.24 x .394 x .36 .36 x .394 x .24	P	±20	0.5	125	280°	Yes	100-2 Meg. 100-2 Meg.

RESISTON CARBON — ADJUSTMENT POTENTIOMETERS

 3068	Commercial E-Z-TRIM Potentiometer	.36 x .28 x 1.0	P	±20	0.20 at 25°C	85	15	No	20K-1 Meg.

VARIABLE RESISTORS

 3359P	3/8" Single-Turn Cermet Element	Standard Resistance Range ..... 100 to 2,000,000 ohms Power Rating ..... ½ watt at 70°C, ¾ watt at 40°C Humidity ..... Less than 1% change in total resistance after 500 hours
3359W	3/8" Single-Turn Cermet Element	Resistance Change After Solvent Bath in FREON T.F. or Trichloroethane ..... Less than 1% Operating Temperature Range ..... −65°C to +125°C

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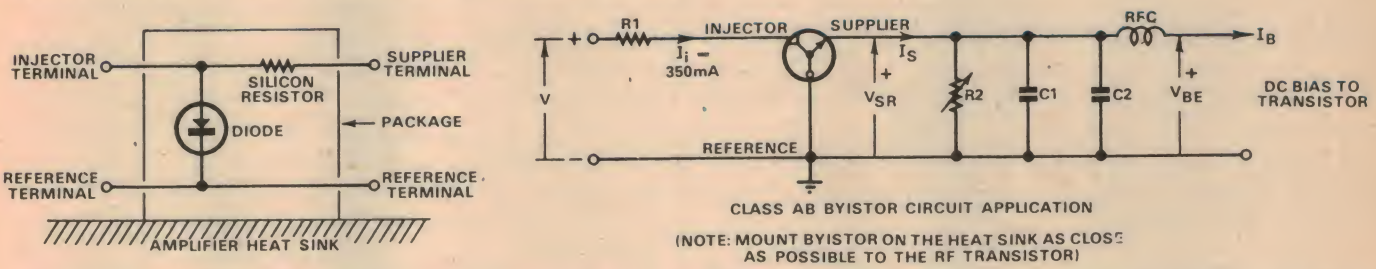
MELBOURNE: 2 High St., Northcote 3070. Phone 489-9322
ADELAIDE: Phone 267-2246
BRISBANE: Phone 52-7255
PERTH: Phone 25-5722

ATE8125/173

Circuit & Design Ideas

Interesting circuit ideas and design notes selected by the Editor from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsiblity cannot be accepted. Contributions to this section are always welcome.

New device for linear amplifier bias



CLASS AB BYISTOR CIRCUIT APPLICATION

(NOTE: MOUNT BYISTOR ON THE HEAT SINK AS CLOSE AS POSSIBLE TO THE RF TRANSISTOR)

The Communications Transistor Corporation has introduced a new semiconductor device called a "byistor", to be used as the key element in a transistor bias network for RF linear amplifiers. The advantages of using a byistor are the excellent tracking for DC stability and the significantly simplified bias circuit. Furthermore, supplemental emitter resistance is not needed to ensure DC stability.

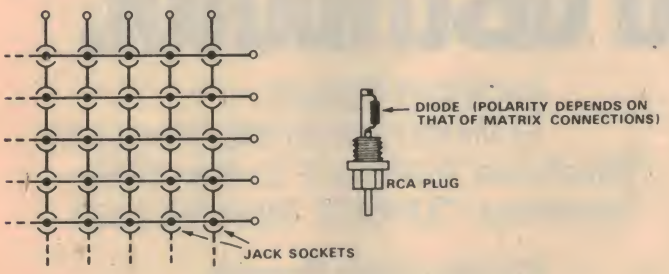
The capstan type of package contains a diode fabricated like an RF power transistor with the same material, geometry and diffusion, which provides one phase of thermal tracking. It also contains a silicon resistor which provides a second phase of thermal tracking. The whole unit is fabricated and assembled with the same consistency and precision used in building RF power transistors.

The diagrams show some details and application of a byistor. By inserting a constant current in the injector terminal, a diode acts as a voltage source with approximately 0.3 ohm source impedance. The addition of a silicon resistor (approximately 0.7 ohm) increases the apparent source impedance of the byistor to approximately 1 ohm.

The silicon resistor increases in resistance and the diode voltage decreases with increasing temperature. As a result, the source impedance of the byistor increases and the bias voltage decreases with increasing temperature. Thus, by mounting the package on the same heatsink as physically close to the RF power transistor as possible, the byistor will thermally track the transistor and compensate for the reduction in Vbe. The result is improved DC stability of the amplifier and elimination of thermal runaway of the RF transistor.

(From "Variscope".)

A simple programming board



Here is a simple type of programming board which I find very useful for digital logic circuitry. It consists basically of a matrix of jack sockets mounted on an insulating material, such as perspex. I have used RCA plugs and sockets as I find them easy to use and more reliable than some other types of connectors.

Programming is carried out by inserting jack plugs, which have diodes connected across them, into the appropriate sockets. To scan the columns I use a ring counter made up of 7476 J-K flip-flop ICs. This allows me to have more than one high state position on the columns. However, if this is not required a single decoder IC could be used, depending on the number of columns, eg, the 74145 for 10-line or the 74154 for 16-line decoding. These ICs are driven by BCD and binary counters respectively, and give active low outputs which, for best results, should be buffered to give a good fan-out. A suitable device would be the 7404 hex inverter IC. While not strictly a buffer it has a fan-out of 10, which I find suitable for most applications. In addition, it inverts the output to give an active high.

The main cost is for the sockets. It may be possible to find a disposals source of PMG type jacks and sockets, to keep the cost down. Also, due to the larger size of the PMG items, they would be easier to handle.

(By Mr R. L. Schipper, 45 Melbourne Place, Alberton, South Australia 5014.)

Notes on Playmaster 138 program source

I have built the Playmaster 138 Program Source which was described in December, 1972. As the sharp selectivity which it offers did not interest me, I left it out. Two problems arose and my findings may be of interest to other readers.

The self-oscillating mixer appeared to be also oscillating in a spurious mode, in addition to the wanted oscillation. Probing around with a finger revealed that the spurious oscillation stopped when I touched the fixed plates of the oscillator section of the gang. This suggested the unorthodox method of shunting the capacitor with a resistor, and a 100k did the trick.

An excessive amount of background hiss was in evidence and this was cured by removing the 0.1uF bypass capacitor across the emitter resistor of the last 1F amplifier before the detector. This had the effect of reducing the gain of the stage, and thus by AGC action putting more signal into the mixer, yielding the higher signal-to-noise ratio.

Just one more interesting point — I built the unit on matrix board, rather than a printed board. Now I have relegated the old valve tuner to the garage.

(By Mr R. A. Caddy, The University of NSW, P.O. Box 1, Kensington, NSW 2033.)

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More on the phase-locked loop demodulator

(Editorial note: In Circuit & Design Ideas for December, 1973, we gave brief details of a phase-locked loop demodulator using the SN7401 IC. Readers may be interested in this further information which has come to light.)

I made up the phase-lock loop using the SN7401 and although I have only patched it into the HF receiver it seems to be performing as claimed. For reasons of convenience only one IF stage is used instead of the usual two but the sensitivity was only just below normal. There were no FM stations to judge its true performance but it was interesting to start off with low signal strengths where the loop just failed to lock and then turn up the gain to obtain lock.

Although, of course, these were AM stations, some audio was resolved, at reduced strength but good quality — possibly due to unintentional rectification in the IC — or some frequency modulation on the AM carrier!

I can confirm the variation in characteristics with each device. I found that when C1 was 22pF as shown, the frequency was about 4MHz and I had to use a nominal 1000pF to get near 455kHz; I found R7 (4.7k preset) essential for adjustment to a definite frequency. I made R6 10k since there seemed no point in having a 2MHz locking range with a 4kHz bandwidth in the receiver, and perhaps the change in this value was one reason for the change in operating frequency.

Voltage readings with no RF input were: HT rail, 5.2V (13mA); pins 1, 6, 8 and 9, 0.95V; pins 2, 3 and 13, 1.46V; pin 4, 3.5V; pin 5, 1.5V; pins 10, 11 and 12, 0.9V. To sum it up, I do not know how the sensitivity compares with a purpose-built phase-lock loop device — but evidently it is a usable idea.

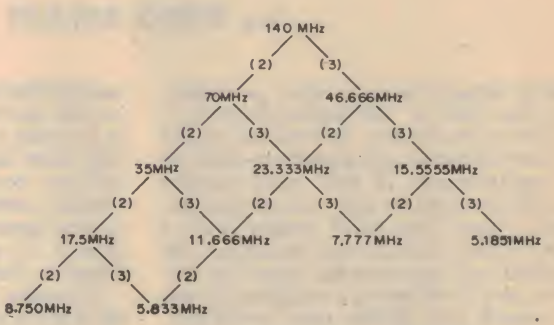
(By Joe Cropper, G3BY, in "Radio Communication".)

A simple frequency-multiplier chart

There are times when a VHF builder would like to see all the possible multiplication products to a given output frequency. This need arises when planning receiver local oscillators, where the desired output frequencies are not as familiar as those of transmitter multiplier chains. The following simple chart allows one to see all the possible choices at a glance. In the practical example shown here, an injection frequency on approximately 140MHz was needed for converting a commercial FM receiver to two-metre operation.

The method assumes that only doublers and triplers are being used. Divide the desired output frequency by either 2 or 3. The locations of these numbers can be deduced from the second row of the chart. The multiplier factors are shown in parentheses. Divide the numbers obtained by the previous division and mark them down in the third row from the top. Continue the process until all possible crystal frequencies are reached.

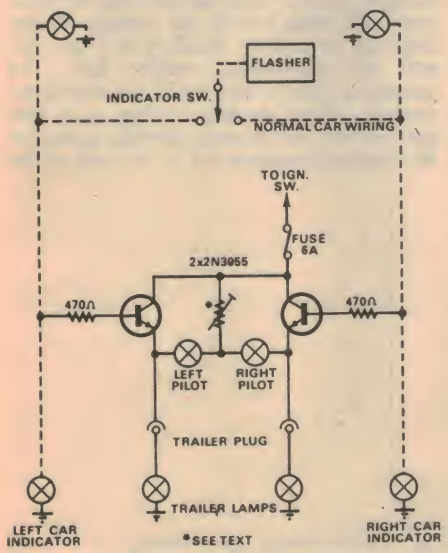
With the products thus displayed, the constructor can choose a frequency based on his own particular requirements. Most crystal



manufacturers have a change in their price structure in this area and you may be able to get on the low side of a price difference by proper frequency selection.

(By Ed Valmore, K2EVJ, in "QST".)

Trailer flasher unit



Having had some problems in obtaining a suitable commercial flasher unit to fit to my trailer, I decided to make one up myself. In addition to the fundamental requirements for such an installation, regulations require that some means be provided to indicate to the driver that the added flashers are in fact working correctly. The unit to be described meets all these requirements.

The circuit is quite simple and there seems to be no reason to describe its operation in any detail. The left and right trailer indicating lamps form a return circuit for each of the pilot lamps when the ignition is switched on. The pilot lamps must be of a low wattage rating so as not to make the trailer indicating lamps glow. The trailer lamps should be about 20 watts each. A rheostat may be connected in series with the pilot lamps to reduce their brilliance for night driving.

Both pilot lamps will light up when the trailer plug is connected. When either direction is indicated, the appropriate lamp will flash. If an indicating lamp is open circuit the pilot lamp will go out, with or without the direction indicator being on.

The assembled unit, which may be on a printed board, may be mounted under the dash and the wires connected to the outgoing side of the indicator switch. For systems using a positive frame connection PNP transistors must be used, otherwise the circuit remains the same.

(By Mr W. Garrett, Lot 825 Army Avenue, Tanilba Bay, NSW 2301.)

(Editorial Note: Since preparing the material for this item, Mr Garrett has advised us that in cases where trailer lamp power runs towards 100 watts, the two 470 ohm resistors may be reduced or even eliminated altogether.)

The Heathkit Model GD-48 Metal Locator

For would-be "treasure hunters", this metal locator kitset from the Heath company is a reliable instrument for locating buried metal objects. Its principal features include lightweight, rugged construction, high sensitivity, and ease of operation.

by GREG SWAIN

Metal locator projects have previously been described in "Electronics Australia", the last in the January 1970 edition. Whilst we have not had an opportunity to compare the performance of the metal locator described in January 1970 with the Heathkit Model GD-48, the latter should have a higher degree of sensitivity. In addition, the Heathkit unit is somewhat easier to construct, as it is offered as a complete kit with the search and pickup coils pre-wound.

As with all Heathkit projects, the Model GD-48 Metal Locator comes complete with the usual comprehensive assembly-instruction manual and is backed by the Heath Company's "Factory Repair Service" warranty. A troubleshooting chart is included in the back of the manual to assist those constructors who experience difficulty in putting the unit into operation. In fact, the instruction manual is so detailed that this kit would be quite suitable for those contemplating the construction of their first electronic project.

The GD-48 Metal Locator uses 8 transistors and 1 diode, in a fully solid state circuit designed to give economical operation from a 9V battery. A single control (the sensitivity control) provides for ease of operation and enables the operator to pinpoint metal objects with accuracy. The Model GD-48 is a particularly handy unit for locating water pipes, household electric wiring, buried cables, manhole covers, survey markers, and similar metal objects. In addition, it can be used for "treasure hunting" on the beach, etc.

A speaker and a meter are mounted on the control panel to give both audio and visual indications when a metal object is detected. A headphone jack is also included on the front panel to enable headphones to be used in areas where the surrounding noise level is high.

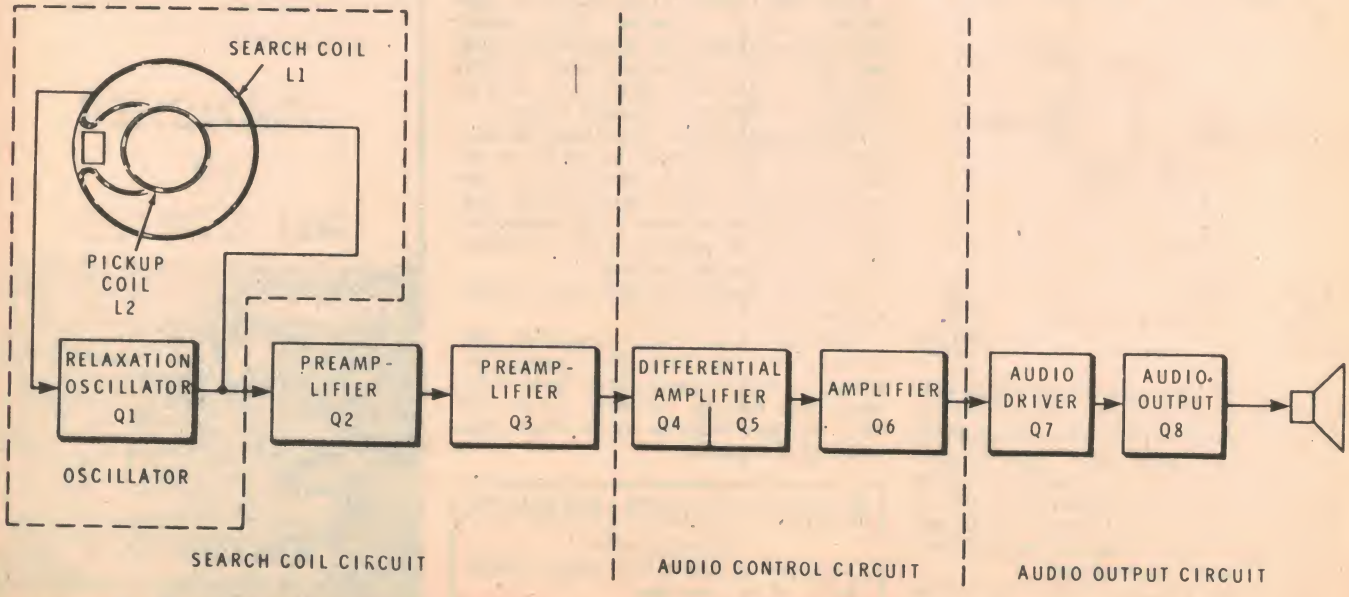
The theoretical aspects of the unit's operation may be considered at this stage. Basically, the unit consists of three separate circuits: the search and pickup coil circuit, the audio control circuit, and the audio output stage. The search and pickup coil circuitry is contained within the search coil housing, whilst the two audio circuits are contained in the control panel assembly mounted at the upper end of the shaft.

The pickup and search coils are the primary elements involved in the detection of metal objects. Transistor Q1 and its associated components form a relaxation oscillator which energises the search coil. A frequency of 100kHz, modulated by a frequency of 650Hz, is used.

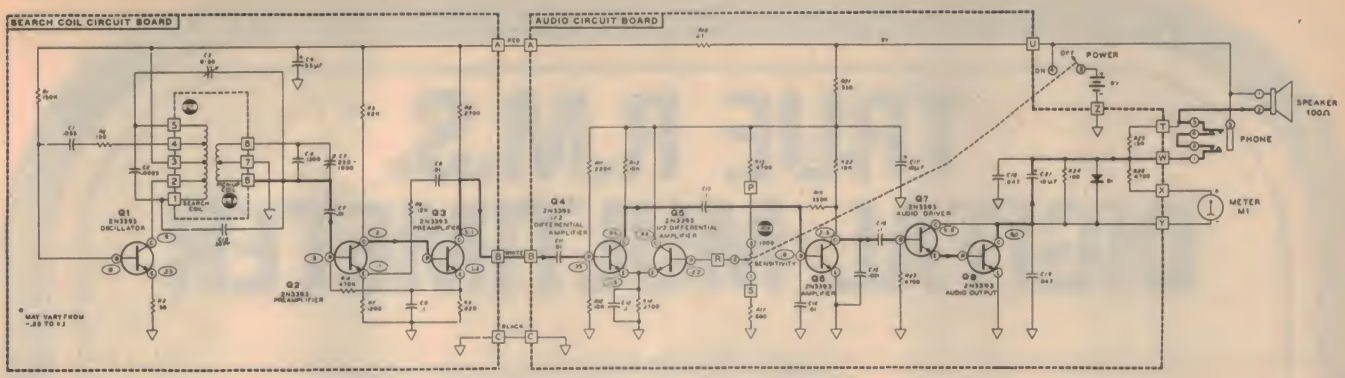
The frequency of oscillation is controlled by the values of the search coil L1 and capacitor C2. Feedback is supplied through resistor R2 and capacitor C1, the time constant effecting the biasing of this stage such that transistor Q1 is alternately turned on and off to provide the 650Hz tone that is heard from the speaker.

The signal from the oscillator circuit is coupled through capacitor C7 to the base ot transistor Q2 via two separate paths. The first is an inductive path from the search coil L1 to the pickup coil L2. The second is a capacitive path via capacitor C3, the signal through this path being opposite in phase and of equal amplitude to the signal applied to the pickup coil by magnetic induction. Therefore, in the absence of a metalic object, these two signals will cancel each other. Capacitor C3 is adjusted during the alignment procedures to obtain the optimum null condition between the two coils.

The DC operating point of transistor Q4 is controlled by transistor Q5 and the common emitter resistor R14, the DC bias on transistor Q5 being set by the voltage divider network formed by resistors R15 and R17 and the sensitivity control R16. The operating point is then set by the sensitivity control, whose normal setting is at that point where the current through transistor Q5 causes transistor Q4 to be just at the



This block diagram of the GD-48 Metal Locator should be studied in conjunction with the text.



point of cut-off.

When the magnetic field between the two coils is disturbed by a metal object, this null condition will be upset, resulting in an increase in the output signal from the pickup coil. This output signal is coupled through capacitor C7 to the base of transistor Q2. Transistors Q2 and Q3 form a direct coupled amplifier which amplifies the signal from the pickup coil to the level required by the differential amplifier (Q4 and Q5) in the audio control circuit.

When a metal object is detected, the increased signal applied to the base of transistor Q4 causes Q4 to conduct and amplify the change in signal level. The fact that the differential amplifier only amplifies the change in signal level makes the unit extremely sensitive to small signal changes that would not ordinarily be detected in a normal linear amplifier. The signal then undergoes further amplification by transistor Q6.

Transistors Q7 and Q8 are in Darlington pair configuration, and operate as a single ended class B output stage. Under no signal conditions, transistors Q7 and Q8 are biased at cut-off, resulting in a reduction in the quiescent current and an increase in the life of the battery. The signal from the collector of Q8 is then coupled through C21, through the phone jack to the speaker.

The meter forms part of the collector circuit of Q8, any increase in the collector current of Q8 resulting in a corresponding increase in the meter reading. Diode D11 limits the amount of current through the meter to a level that will prevent damage to the meter mechanism.

Construction of the unit is quite straightforward and, provided the instruction manual is carefully followed, no wiring difficulties should be encountered. Most of the components are mounted on two 7 x 5cm printed wiring boards which have been coded to minimise the chances of a wiring error being made. The audio circuit board is mounted on the back of the speaker magnet in the control panel housing, whilst the search coil circuit board is mounted on the search coil assembly. It is then simply a matter of wiring in those major components which are not on the printed wiring boards. These components include: the search and pick-up coils, the sensitivity control, the headphone jack, the meter, and the speaker.

A plastic cover protects the search coil assembly, and the whole assembly is made moisture proof by the use of a special sealant supplied with the kit. Signals from the search coil circuit board are supplied to the audio circuit board via a three wire spiral cable running up through the extendable metal handle.

The unit is powered from a 9 volt battery

Above is the circuit diagram of the Heathkit Model GD-48 Metal Locator as published in the Heathkit assembly manual. The photograph below illustrates the neat and compact arrangement of the completed unit.

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Metal Locator

which fits between the speaker and the back of the speaker bracket. The recommended type number for this battery is the Heath Company Model GD-48-1, or a NEDA 1602 or equivalent. This is a cardboard cased battery, the smaller metal cased batteries not being recommended for this unit as the metal case could possibly short against the copper pattern of the audio circuit board. In addition, the current requirements of the GD-48 further renders the use of a single metal cased battery unsuitable.

The snag in practice is that the recommended battery type is not readily available in this country. Our solution was to use two metal cased 9V batteries (Eveready 216) in parallel. These were insulated from the audio circuit board by wrapping insulation tape around them.

Detailed alignment instructions are presented in the instruction manual so that the metal locator can be adjusted for optimum results. Although theoretically the alignment procedure is a simple matter of adjusting the two variable capacitors C3 and C5 to obtain a null condition between the search and pickup coils, these adjustments are not particularly easy in practice. In fact, the null condition depends quite critically upon the value of C3. In addition, the raucous tone that issues forth from the speaker for the most part of the adjustment procedure is particularly irritating. However, provided one is willing to exhibit a certain amount of patience, this step will be successfully negotiated.

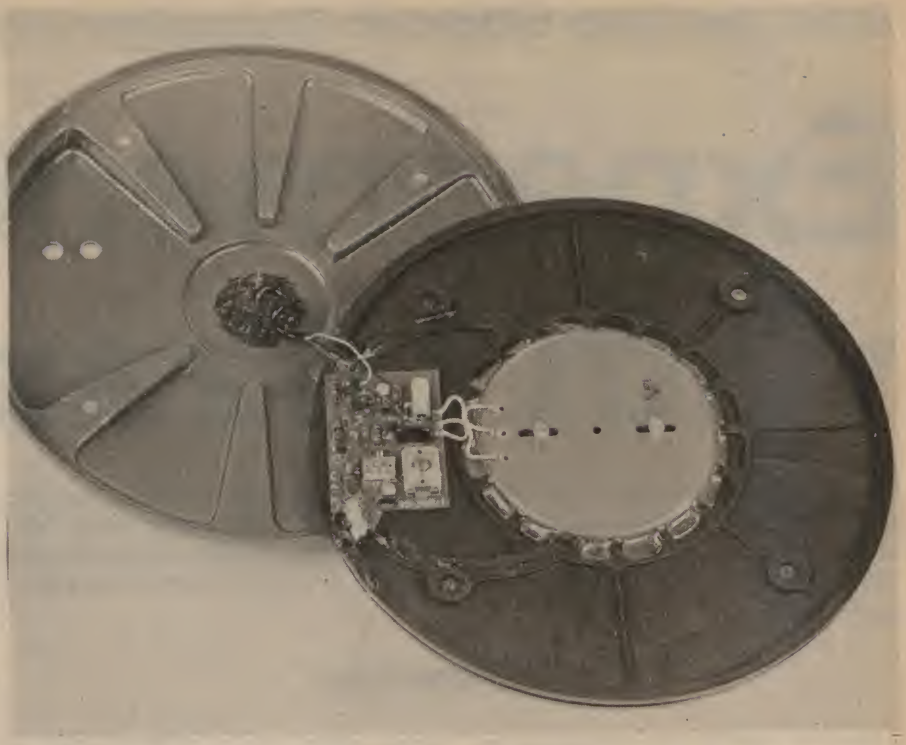
Operation of the GD-48 Metal Locator is quite straightforward. For normal operation, the search coil is held about 2 inches above the ground and the sensitivity control is adjusted to the point where an audio signal can only just be heard. The sensitivity control is then retarded until the audio signal stops and the unit is ready for operation.

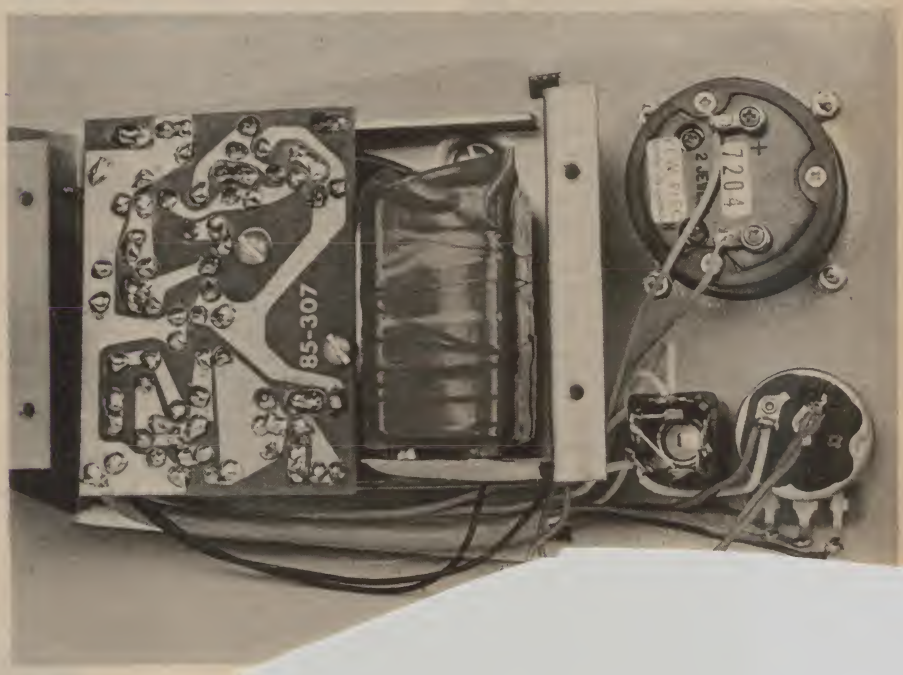
As the search coil passes over a metallic object, an audible tone is emitted from the speaker and the meter needle is deflected. The most sensitive spot on the search coil is just forward of the swivel assembly. When this spot is passed directly over a metal object the strongest audible and visual indications will be obtained, thus pinpointing the location of the object.

When searching for small metal objects, such as a coin, or for deeply buried metal, the signal meter provides a more sensitive indication than the audio signal. For this mode of operation, the sensitivity control is set to give a reading of 2 on the signal meter with the search coil about 2 inches above the ground. When a metal object is detected, the signal meter reading increases. The audio tone will also increase. Headphones, which are available as an optional extra for the metal locator, may also be used to provide a more sensitive means of detecting this increase in audio tone. The speaker is automatically disconnected when headphones are used.

As stated above, the raucus tone made by the loudspeaker is particularly irritating, and a switch to disable the speaker when the unit is operated in the high sensitivity mode would be a worthwhile feature. Individual constructors may care to incorporate this suggestion into their own units. Alternatively, a dummy headphone jack could be used.

The depth of burial to which an object can be detected is a function of such factors as





The search coil circuit board is mounted on the search coil assembly as shown above. Below is an interior view of the control panel housing showing the disposition of the major circuit components.

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When tested at the author's home, ...
48 metal locator proved capable of tracing
water pipes for some distance away from
the water meter. No difficulty was experienced in tracing out a 2-inch metal pipe

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by LEO SIMPSON

Recently, one of our well-known advertisers, Dick Smith Electronics, has become the sole Australian agents for a compact ultrasonic transducer. it has no brand name but just the enigmatic type number, 105. Price is $5.95 each, including sales tax. They will be available both from Dick Smith Electronics and from any parts supplier in the country who sends him an order. (They are advertised in this issue)

The transducers contain a ceramic piezoelectric element which resonates at around 40kHz. Signal connection to the element is made via an RCA type phono socket. Measured capacitance of the element is of the order of 2000 picofarads. Other than this, we have no specifications for the type 105, but Dick Smith tells us they are electrically very similar to some featured in the May 1972 issue of "Practical Electronics". These had a maximum voltage rating of 20V RMS but could be pulsed with 30V RMS at a low duty cycle.

To perform basic experiments with these ultrasonic transducers, you will need at least two of them. One used as the transmitter and the other used as the receiver or detector. In addition, you need a trnasmitter circuit, and a receiver circuit to close a relay or give some other indication that a signal has been received or interrupted.

Let us first describe the circuits we have developed and then we can list some of the possible applications.

We have developed two simple transmitter circuits using easily available components. The first of these is shown in Fig 1. It is a conventional multivibrator consisting of two silicon NPN transistors. The output signal is coupled directly to the transducer from the collector of one of the transistors.

Since the signal developed across the transducer is a square-wave, albeit slightly rounded off, the amplitude has an effective value approximately equal to half the supply voltage. Thus, for a multivibrator supply voltage of 9V, the effective signal voltage will be approximately 4.5V RMS.

Supply voltages to the multivibrator can be anywhere in the range from 6V to 18VDC. Current drain at 9V is only 4 milliamps which means the battery would last a long time. Note that the circuit will work at below 6V, although the output may be so low as to be unusable.

A 10k preset potentiometer is provided to "tweak" the multivibrator frequency so that it is at the approximate 40kHz resonance of the transducer. In practice, the adjustment will be a compromise between maximum acoustic output from the transmitter transducer and maximum sensitivity of the receiver transducer, because the resonant frequency of each transducer differs slightly.

One problem with these transducers is that one side of the element is connected to the shell which is then automatically connected to the metal case of the device in which it is used. Because of this, both the wiper of the preset potentiometer and the aluminium box is connected to the positive supply line from the battery. With this arrangement, an access hole can be provided in the side of the case for screwdriver adjustment of the pot and there will be no risk of shorting out the battery by the shaft of the screwdriver.

The value of the potentiometer has been selected as a compromise between ease of adjustment, range of adjustment and ready availability. If the higher supply voltages are used it may be necessary to add a resistor (say 4.7k or more) in series with the potentiometer to give it a suitable range of adjustment.

While the transmitter circuit in Fig 1 is very economical in terms of battery drain it is suitable only for low power applications such as monitoring doorways or narrow passageways. If higher power is required, the circuit in Fig 2 should be used. This circuit is fundamentally the same as Fig 1

At left is the prototype receiver while to the right is the transmitter, both using the same transducer.

ıut has the advantage that the voltage ıtput to the transducer is doubled while the ttery voltage remains the same.

Using the same transistors, the circuit has been redesigned with lower value collector load resistors (1k). This allows the tranducer to be connected directly across the two collectors. Since the output waveform at each collector is a square wave with a peak value just slightly less than the supply voltage and the two waveforms are 180 degrees out of phase, our method of connection gives a "push-pull" operation to the transducer and doubles the amplitude of the waveform. The effective value of the output is almost equal to the supply voltage.

A 5k potentiometer provides adjustment of the frequency and it is shunted by a 0.01uF capacitor to improve the shape of the waveform and aid in reliable starting. Note that for supply voltages above 12V a resistor of 2.7k or so should be added in series with the preset potentiometer to give it the correct range of adjustment. As before the supply can range anywhere from 6V to 18V.

An interesting feature of this "push-pull" circuit is that once the preset potentiometer has been adjusted to give the resonance frequency of the transducer, the oscillator tends to lock in so that further manipulation of the potentiometer does not shift the frequency appreciably. It merely changes the waveform slightly.

Current drain of the circuit with a 9V battery is of the order of 12 to 13 milliamps. This is higher than one would expect with the resistor values in the circuit but the loading effect of the transducer does increase the current. With intermittent use, an Eveready No 216 or similar battery should have a reasonably long life. If continuous use is envisaged, a larger battery should be used.

Having described the transmitter circuits, we can give some details of their construction and then go on to describe the receiver circuits.

While both transmitter circuits were subject to quite a bit of experimenting we built the higher-powered circuit of Fig 2 into a standard over-the-counter aluminium utility box to present a suitable method of construction. The lower-powered circuit can use exactly the same method of construction. No doubt readers will have their own ideas in this regard and can rest assured the circuits are in no way critical apart from the few points noted above.

Outside dimensions of the aluminium box are approximately 103 x 62 x 60mm (4 x 2¼ x 2⅜in) which allows plenty of space to mount the various components. We drilled and reamed a hole of approximately 25mm diameter in one end to accommodate the transducer. Those without a suitable reamer will have to cut the hole by drilling a circle of smaller holes and then filing the cut out to size, or perhaps by drilling a clearance hole and using a hand nibbler.

While we could have set the transducer in position with an epoxy adhesive we elected to hold it with a clamp made from a piece of aluminium measuring 50 x 30mm. A hole large enough to clear the RCA phono connector (say ½in) is drilled in the centre of the aluminium and two additional holes drilled to take suitable screws to secure the clamp.

A short length of shielded cable carries the signal output to the trandsucer. Do not overtighten the screws on the transducer clamp otherwise it may cause intermittent

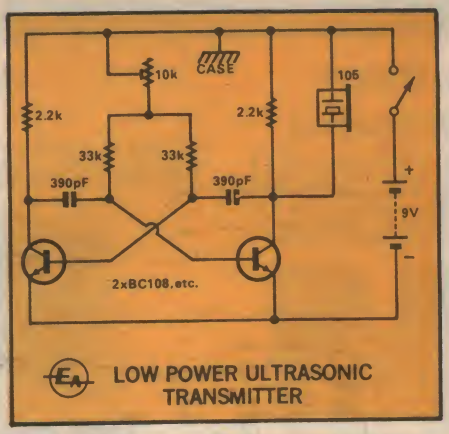


Fig 1: A simple multivibrator transmitter.

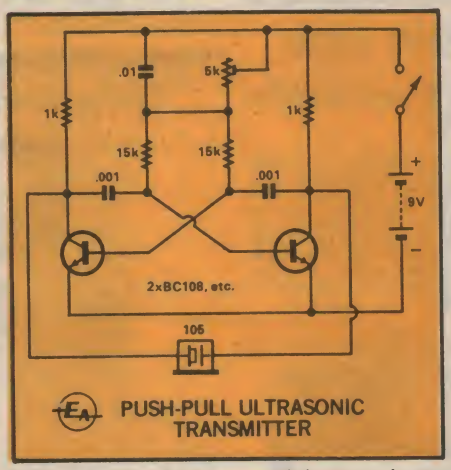


Fig 2: Push-pull operation of the transducer.

behaviour in the transducer and perhaps distort the aluminium box.

All of the circuitry is accommodated on a piece of Veroboard measuring 45 x 45mm approx and having 0.1in conductor spacing which suits Lockfit transistors. The layout is not critical but note that several of the conductors are bridged together in the circuit. This is shown in the wiring diagram.

A miniature toggle switch is used for the on-off switch but this could be a "momentary-contact" pushbutton type if the particular application demands it.

Note that because of its construction, one side of the transducer is connected to case. This means that the screwdriver used to adjust the preset potentiometer of the push-pull transmitter will have to have an insulating sleeve fitted to its shaft, otherwise thw multivibrator will stop when the screwdriver shorts the pot wiper to case. As noted above, this problem is circumvented in the low power circuit.

The battery is held in place by a clamp made from a scrap of aluminium. Note that if brass spacers are used to mount the Veroboard, the copper pattern should be cut away so that the circuit is not inadvertently connected to case.

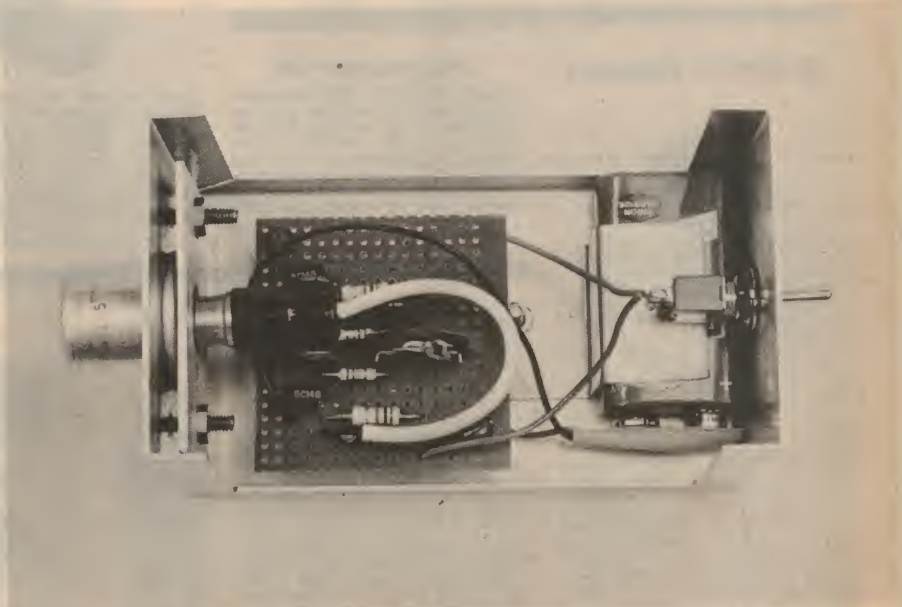
Incidentally one can get a weak but usable acoustic output from these transducers over the audio range above 1kHz, by connecting them to an audio frequency generator with low impedance and output of 3V or more. The output is peaky, but it may possibly be useful in some situations.

Now we can go on to describe the receiver circuits, of which there are two. The first closes a relay when it receives a suitable signal. The second closes a relay when the signal it is receiving is interrupted. Refer now to the circuit in Fig 3.

One of the first problems we became aware of when designing a receiver around these transducers was the transducers have an appreciable response to sounds within the audio range. For example, with the transducer unloaded, one could whistle loudly close to it and get an appreciable output voltage. Clearly, this just would not do for applications such as burglar alarms or garage door-openers. Every youngster in the street would soon be opening your garage by whistling at it!

Another problem is the very small output voltage from the transducer, which requires a lot of gain to enable a relay to be controlled. We calculated that the necessary gain is of the order of 10,000 times or more.

An initial suggestion from one of the



Component layout inside the transmitter case. Note the details of the clamp securing the transducer. Do not overtighten the clamp.

Dick Smith Electronics Centre

New Hi Fi Section Opens

In charge of the new Hi Fi Demonstration Room is David Smith. David has a technical background and has been with two of the top Discounters. "Look at the gear in your local store," says

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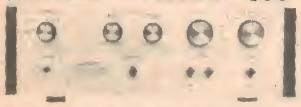

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DSHF2 System

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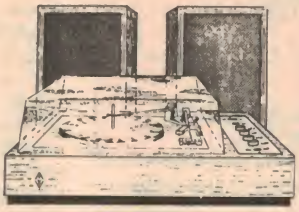
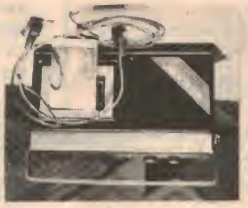


NEW NEW

Sanyo 3-way cassette recorder

is a fantastic machine — records and plays in mono BUT will play stereo cassettes in STEREO through the FREE headphones we give you (ain't that a beaut idea?) It's tremendous value at only $79.95. And in addition to the FREE headphones we also let you choose a stereo cassette to show the Sanyo off to your friends!



Call in and see the systems working. Discuss your requirements in a friendly atmosphere. No hard selling, we know the prices and gear are right. Browse through our huge selection of tapes and discs — LP's from $1.99, Cassettes from $3.99 and 8 track cartridges from $3.99. Just ask for David Smith and get the advice you'll appreciate — and so will your Bank Manager!

12V Relays

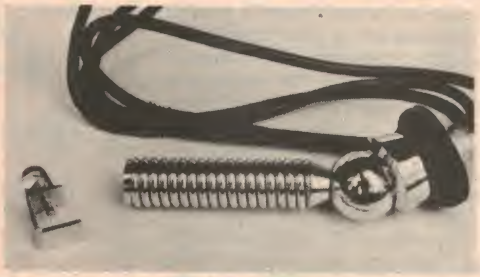
Type H2

is a heavy duty job for car horn and general auto use. Contacts, rated at 20A. Called the Elephant — imagine what it takes to switch them on!! Single on-off contact with screw or push-on connections $1.50.

Light Relay

is a super-dooper relay for auto use with numerous applications. Features twin coils for reliability or can be used as two separate relays in single (metal) case. Each make / break contact is independently fused at 30A so wire in parallel and switch 60A. Only $3.95.

Fibreglass Car Aerial Bargain



Imagine a 75 inch flexible fibreglass aerial for only $8.95. It's ridiculous isn't it? But ours has a chrome plated spring and swivel ball base. Plus 1.2 metres of connecting lead with plug. And a gutter clip. Yes it's a complete do-it-yourself installation for only $8.95. Don't tell your friends how cheap it was, they'll only want one and we're bound to sell out fast.

Ultrasonic transducers

Imported from USA. You've seen them in Wireless World, PW etc. Range up to 80 feet and no licence required. Ideal for burglar alarms, remote control etc. Type 105 has a ceramic phono-type socket for easy connection. Operates at 40kHz (circuits available if required with your order). Trial shipment of 50 only so hurry $5.95 each.

Stop / Go LEDs

Here's one for the model railway nuts. Build a LED signal with our $2 package of one red and one GREEN LED. Both top manufacturer and available separately RED CEMA RL209 at 60 cents and Green Plessey QLD 329 at $1.40. Or $2.00 a pair.

Rainbow cable

You've been asking us for this professional FLAT multicore cable. Well it's arrived. 12 colour coded multistrand wires bonded together into a flat cable. Ideal for looms, edge connectors etc 55c per yard with normal hook-up wire ratings.

Expo drill kit

made in England by a top specialist in this field. As used by dentists and jewellers. Will drill, saw, grind, burr, brush or polish. Drills holes up to 3mm. Kit contains 20 assorted tools and 9,000 rpm minimotor and chuck. Operates from 12V DC. We've already sold one to a chiropodist so what are you going to do with yours. $22.95.

E-Craft Baluns

It isn't too early to get ready for Colour. Start by updating your TV aerial installation. Baluns improve the match between antenna, feeder and set and are easily installed at the antenna. Ideal where ghosting is a problem due to mismatches and we have heard of people in fringe areas dramatically improving reception. Waterproof and easily fitted matches 300 ohm to 75 ohm $3.10. Don't spoil the installation use our low noise 75 ohm coax 20 cents per yard.

Playmaster 140

Despite numerous requests we have decided not to do a kit for this one, following our experience with the popular 136 kit. We have been waiting over 3 months for the special offer transistors and it is impossible to substitute for the special epoxy devices. We don't want any more frustrated constructors, so sorry No 140 kit.

Spray Galvanise gives 3 years' protection

LPS instant galvanise comes in a 16 oz spray pack. It operates by electromechanical action which fuses 95% pure zinc onto any metal. DO NOT CONFUSE WITH PAINTS. Will withstand 3000hr saltwater spray tests, boiling water and heat to 1000°. Ideal finish or repair to outdoor gear. Can be welded without flash fire. Meets various US MIL specs including MIL-T-26433 for arctic zone towers! Get results comparable with hot dip galvanising with LPS for only $5.50. Remember it isn't a paint, LPS gives rustproofing for 3 years or more.

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members of our staff was to use an operational amplifier integrated circuit to provide the necessary gain. These are available cheaply but a quick look at the specifications of the most commonly used type, the 741, showed that it was not anywhere near suitable for the job.

For a start, while the "open loop" gain (gain before negative feedback is applied) might be several hundred thousand, this only aplies for DC and very low frequency AC signals. At the frequency we are interested in, 40kHz, open-loop gain is considerably less than 100 times. With feedback applied, it would be less again.

Our approach to obtain the necessary gain is to use two cascaded complementary feedback-pairs. Each feedback pair uses a PNP and NPN silicon transistor and gives a voltage gain of 150 times or more. When cascaded, the resultant gain is 20,000 or more.

Signal coupling from the transducer is made directly to the base of the first transistor in the first feedback pair. We can eliminate the usual input coupling capacitor because the transducer is itself a capacitive element and does not conduct direct current. Besides providing the correct bias for the input transistor, the 22k and 33k bias resistors are selected to load the transducer so that its response to signals below 40kHz is heavily curtailed.

The collector current of the first transistor is set by its 33k collector load to a suitably low value to minimise noise. A low noise transistor must be used here otherwise the very large overall gain will result in appreciable residual noise in the output of the preamplifier.

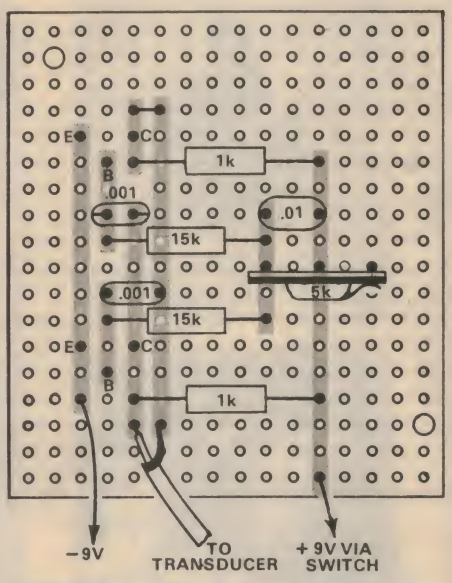
In theory, overall gain of the feedback pair is set by the ratio of the 22k (from the collector of the second transistor) to the 100 ohm resistor. However, unless the first transistor is one with particularly high beta, the actual gain will be somewhat less than the expected 220 times. Low frequency response is restricted below 40kHz by the 0.1uF capacitor in series with the 100 ohm resistor.

Output from the first feedback pair is coupled to the first transistor of the second feedback pair by a .001uF capacitor. This capacitor combined with the 22k and 33k bias resistors again helps to limit the low frequency response of the preamplifier.

A low noise, high beta transistor is specified again for the first stage of the second feedback pair. Here it is specified not so much to give low noise performance but to assure high gain. Its collector current is set higher than in the first feedback pair by its 15k collector resistor. In practice, the gain of the second feedback pair will be close to the expected 150 times set by the ratio of the 15k and 100 ohm feedback resistors.

Readers may wonder why we have opted for the two feedback pairs with AC coupling between them instead of a 4-stage preamplifier (for example) with direct coupling throughout and one feedback loop. In practice, the arrangement we have used is more stable and is less complicated considering the high overall gain.

Output from the second feedback pair of the preamplifier is fed via a .001uF capacitor to a two-stage DC amplifier. The DC amplifier is really an NPN and a PNP transistor operating together as a high-gain class-B detector which drives the relay.



Wiring layout for the transmitter board.

Since the class-B detector conducts only for positive excursions of the preamplifier output signal, substantial filtering of the detector output is required so that the relay will pull in and hold properly. Filtering is provided by the 50uF capacitor in parallel with the relay coil. This capacitor also does away with the need for a protective diode across the relay to protect the driving transistor.

We used a relay with a 185 ohm coil but any relay with a coil resistance of more than this can be used provided its "pull-in" voltage is within the supply voltage of the receiver. While we used a 9V supply for the receiver it could be run at 12V without any adjustment. Higher voltages could be used, up to 18V, provided current drain through the relay is not a problem. If the higher voltages are used care should be taken not to exceed the ratings of the relay driving transistor. Lower voltages than 9V are not recommended as the sensitivity of the receiver would be reduced.

Overall sensitivity of the receiver is controlled by the 10k potentiometer which adjusts the signal level to the class-B detector.

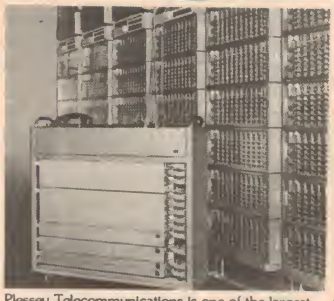
The receiver circuit of Fig 3 activates the relay when a signal of sufficient strength hits the transducer. If the opposite function is required, ie, the relay is activated when the signal to the transducer is interrupted, then the detector circuit shown in Fig 4 should be used.

As with the transmitter circuits, we built one of the receiver circuits into a box to present a suitable method of construction. The receiver circuit of Fig 3 was housed in an STC diecast box measuring 120 x 95 x 55mm which has internal slots to mount a circuit board. We recommend this method of construction as it provides necessary shielding against strong RF signals, which coulud otherwise cause false triggering of the relay.

All the circuitry is mounted on a length of Veroboard measuring 115 x 48mm with 0.1in conductor spacing. The circuit arrangement is shown in the wiring diagram. We have specified Veroboard with

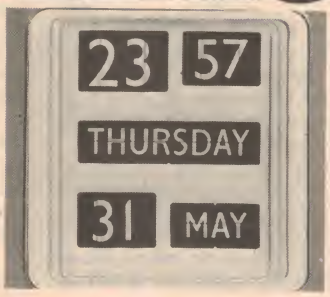
A simple horn made from light cardboard gives useful improvement in range of the transmitter. You can fit one to the receiver also.

Australia



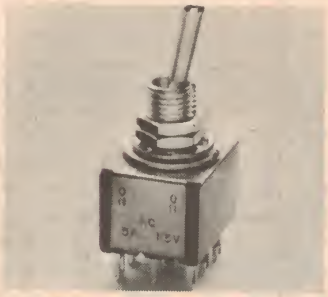
Plessey Telecommunications is one of the largest suppliers of automatic telephone equipment to the Australian Post Office. This crossbar equipment is manufactured and built by Plessey Telecommunication engineers at the extensive Meadowbank, N.S.W. plant.

The world famous Garrard range of turntables is sold and serviced throughout Australia by Plessey Ducon.



This direct reading digital clock is one of a wide range of models supplied by Plessey in Australia. Extremely accurate, the clocks are built for indoor use or weatherproofed and illuminated for outdoors.

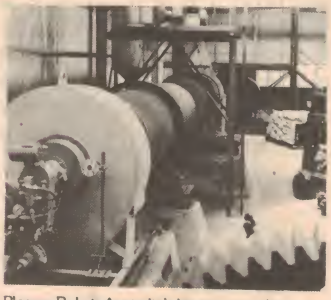
Designed and produced in Australia by Plessey Telecommunications, the 'Computermatic' timber grader completely eliminates the guesswork from visual timber grading. Electronic grading ensures that timber is accurately classified by strength and stability before use.



One of the many 'sub-miniature' switches marketed throughout Australia by Plessey. These switches along with a wide range of electronic components are supplied by the Ducon division of Plessey, located at Villawood, N.S.W.

Plessey Electronics of Richmond VIC, design and manufacture a complete range of high performance transmitter/receivers specially designed for all mobile applications. This MTR 40 series is used extensively in commercial vehicles throughout Australia.

'Ansafon' telephone answering machines are one of the many business efficiency products sold and serviced by Plessey Communication Systems throughout Australia.

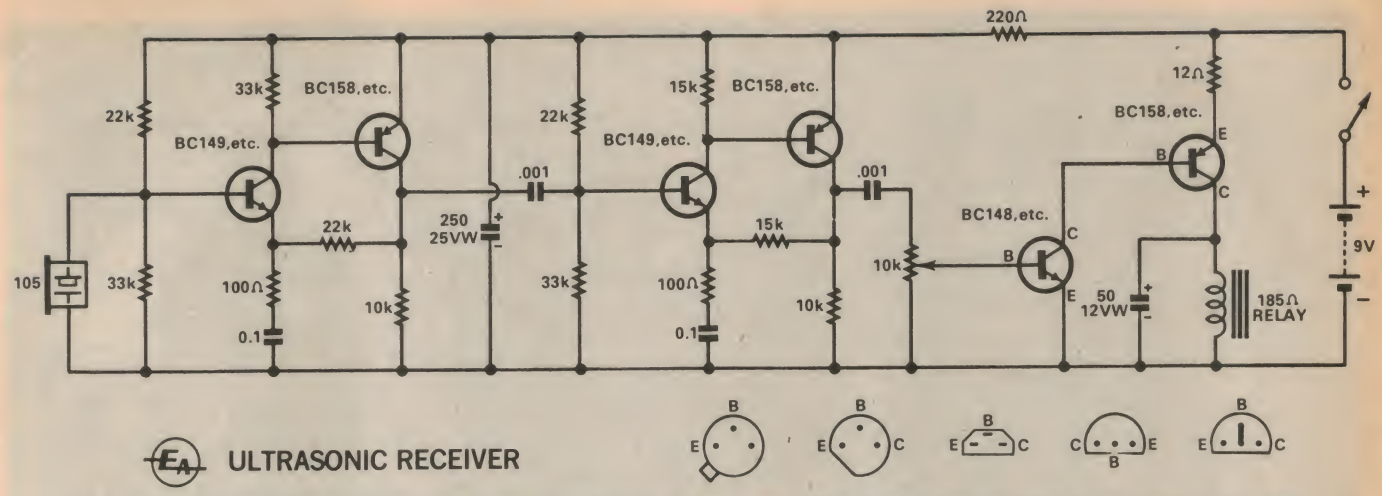


Plessey Rola is Australia's largest manufacturer of magnetic materials. Under agreement with B.H.P., Plessey have exclusive marketing rights for hematite and ferrite powders produced from Yampi Sound.

Number of plants: 8
Factory capacity: 1 million sq. ft.
Employees: 4,000

Plessey

APP7397



EA ULTRASONIC RECEIVER

Above is the layout of the receiver wiring board while below is inside view of the receiver case with the board held in the slots.

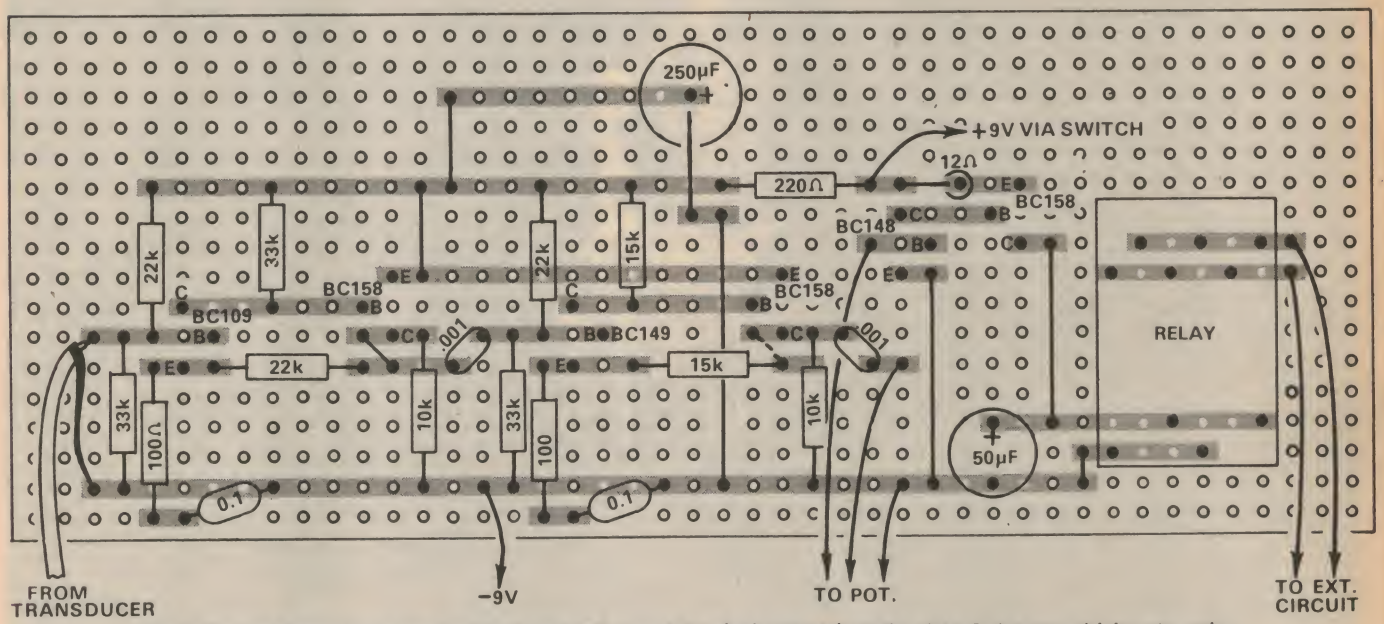
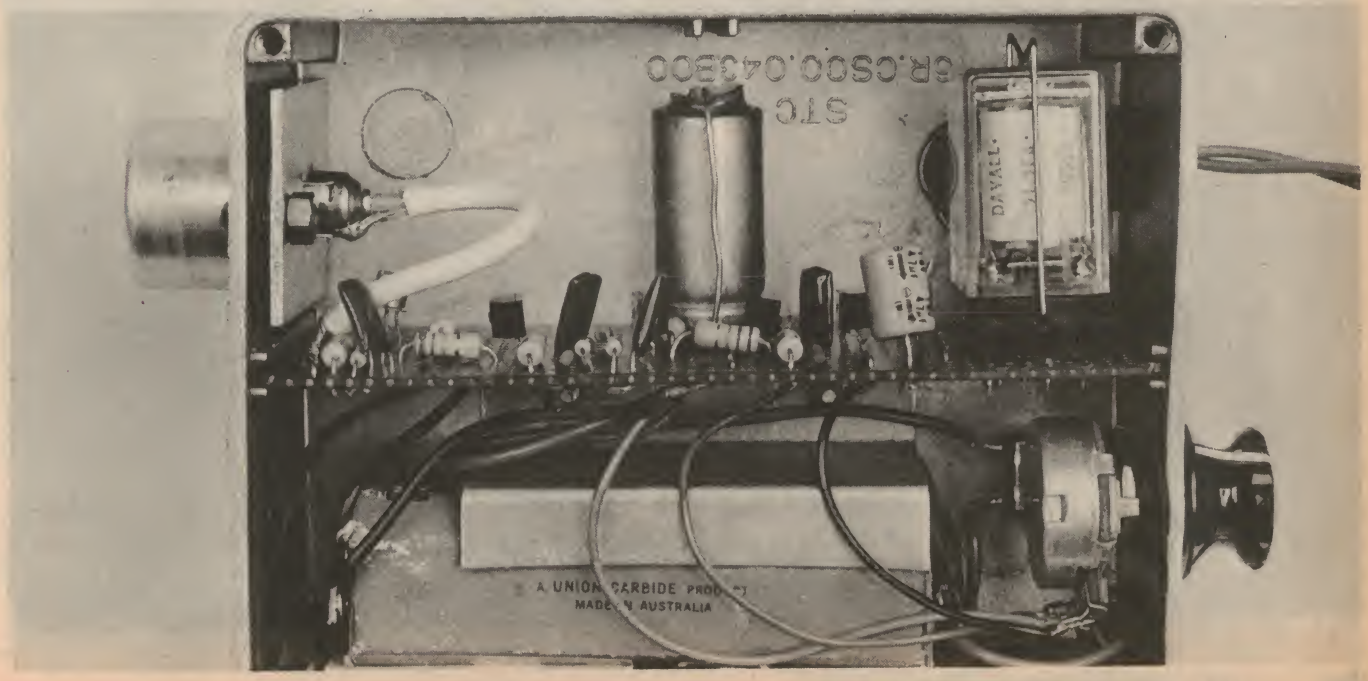


Fig 3: The receiver circuit uses two high gain DC-coupled pairs in cascade and a class-B detector driving the relay.



Work of art 6EA8

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A work of electronic artistry created to pluck a television signal out of the air, designed to receive both audio and video signals, and constructed with the technical perfection of all true works of art.

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0.1in spacing because it suits Lockfit transistors and the relay socket. Holes for the relay socket mounting must be enlarged a little to accept the pins. The relay we used was a Davall 21-2CA which has two sets of change-over contacts, although other relays may be pressed into service as noted above. Make sure you obtain a clip to hold the relay securely in its socket.

Note that the copper strips on the Veroboard should not make contact with the internal slots of the case — strip them back so this cannot occur.

The transducer is connected to the circuit via an RCA male phono plug and a short length of shielded cable. The transducer is mounted in the same way as in the transmitter.

Wires from the contacts of the relay are knotted and passed out through a grommetted hole in one end of the case.

We used an Eveready 2362 9V battery held in place by a clamp made from a scrap of

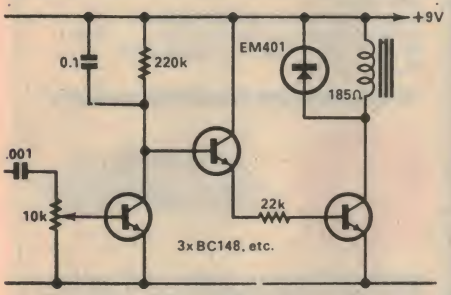

Fig 4: Another class-B detector circuit for tripping the relay if the beam is broken.

aluminium. The snap-on connectors are each covered with a piece of insulation tape to prevent shorts to the case.

A word about transistor types is appropriate here and it applies also to those used in the transmitter. As noted in the parts list there are quite a few different types which suit each stage. While the older soon-to-be obsolete tyeps such as BC108 do not cause any problems as far as the lead configuration is concerned, the new TO-92 encapsulted types have two different lead configurations (on locally available devices).

On those TO-92 plastic encapsulated transitors with the leads in a straight line, the configuration is as follows: With the leads toward you and the flat portion facing down, from left to right the leads are collector, base, emitter. On those transistors with a cranked centre-lead, the leads are emitter, base, collector which is the same as for Lockfit transistors. The various lead configurations are shown on the receiver circuit diagram. Just match them up with the transistor you get in your hot little hand!

And now to some of the interesting sidelights of the transmitter and receiver. One of the strange characteristics of the transducers is that it can resonate audibly while it is driven at 40kHz. Apparently it has resonances at sub-multiples of 40kHz. But even stranger, the audible output changes when the supersonic input frequency changes. And this applies whether the input is a sine wave or square wave.

So if you have sensitive ears and hear strange tweets coming from the transducer you can stop worrying!

With the push-pull transmitter and receiver both operating from 9V batteries we found the effective range was about 6 metres (20 feet). At this range, we found the sharpness of the beam from the transmitter made it very difficult to aim. An improvement in range was gained by fitting a horn to the transmitter, as shown in the accompanying photograph. This was made simply from light cardboard. You can also fit one to the receiver. In fact, with horns fitted to transmitter and receiver and the transmitter running at 15V and tweaked for maximum range we achieved operation over a distance of 9 metres (35 feet).

Be warned though. It takes some fiddling to achieve this range of operation and whether it is reliable enough for some of the applications mentioned below is a matter for the constructor to make up his own mind about.

Let us now discuss some of the applications of ultrasonic systems. One of the most obvious applications is to monitor across a doorway or corridor and for this purpose the low power transmitter should be adequate. This could be the basis of a burglar alarm system, or as a simple "shop-minder".

Many remote control applications come to mind. The units described here could form the basis of a garage door remote opening system, or perhaps a television remote control. As a party novelty, one could have a lot of fun deceiving guests — your imagination sets the limit here.

An ultrasonic counting system would be useful on a production line instead of a light-senstitive system. It would have the advantage of not being affected by ambient light.

Educational experiments could also be devised to demonstrate the behaviour of sound waves. It should not be too hard to set up an experiment to measure the wavelength of the radiation at 40kHz. Here the receiver would drive a metering circuit instead of a relay.

Another worthwhile application would be a pistol range. Combine the push-pull transmitter in a "pistol" set up and use the receiver as the bulls-eye. One of the advantages of this set-up over a light-beam pistol range is that is is unaffected by ambient light — it can be used outside in broad daylight.

THE PARTS YOU NEED:

PUSH-PULL TRANSMITTER:

1 aluminium box, 103 x 62 x 60mm
1 piece of Veroboard, 45 x 45mm, 0.1in conductor spacing
2 silicon NPN transistors, BC108, BC208, PC208, BC548, BC148, or PN3565.
2 x .001uF polyester or polystyrene capacitors
1 x 0.01uF polyester capacitor
1 x 5k preset potentiometer
2 x 1k, 2 x 15k resistors
1 Type 105 ultrasonic transducer
1 miniature SPST switch
1 Eveready 216 9V battery or suitable equivalent plus connector
1 male RCA phono connector
MISCELLANEOUS
Battery and transducer clamps, brass spacers, screws, nuts, lockwashers, hook-up wire, solder.

RECEIVER (Fig 3).

1 diecast box, 120 x 95 x 55mm with internal slots (STC 46R.C-S00.043B00)
1 type 105 ultrasonic transducer
1 male RCA phono plug
1 Eveready 2362 9V battery plus snap-on connectors
1 piece of Veroboard 115 x 48mm, 0.1in conductor spacing
1 relay, Davall 21/2CA or equivalent
1 printed board relay socket to suit above
1 miniature SPST switch
1 knob
SEMICONDUCTORS
2 low-noise silicon NPN transistors, BC109, BC149, BC209, 2N5088, BC549, SE4010.
1 silicon NPN transistor, BC108, BC148, BC208, PC208, BC548 or PN3565.
3 silicon PNP transistors, BC158, BC320, PN3638, PN3638A.
RESISTORS
(¼ or ½W rating, 10pc tolerance)
3 x 33k, 3 x 22k, 2 x 15k, 2 x 10k,
1 x 220 ohms, 2 x 100 ohms, 1 x 12 ohms.
1 x 10k (lin or log) potentiometer.
CAPACITORS
(Voltage rating of plastic types non-critical)
1 x 250uF/25VW electrolytic
1 x 50uF/12VW electrolytic
2 x 0.1uF, metallised polyester
2 x .001uF polyester or polystyrene
MISCELLANEOUS
Battery and transducer clamps, grommet, screws, nuts, lockwashers, hook-up wire, solder.

Note: Resistor wattage ratings and capacitor voltage ratings are those used for our prototypes. Components with higher ratings may generally be used, provided they are physically compatible. Components with lower ratings may also be used in some cases, providing ratings are not exceeded.

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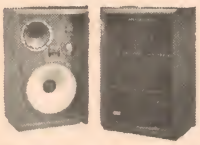

Kit-Sets Australia have imported a range of speaker systems direct from the manufacturers. Never before have such high quality systems been offered at such a low price. The savings have been brought about by our policy of direct importing which brings you, the customer, systems at almost half the normal retail price.

Top of the range is the Model V120 which consists of a roll surround high compliance 12 inch woofer, a 6½ inch midrange (with a crispness which has to be heard to be believed). These two quality speakers are complemented by a highly efficient 1½" Dome tweeter with 120° Dispersion and the most incredible 2" Super tweeter. Presented in a beautiful walnut finished, sturdy cabinet with a wooden slotted grille, rather than the normal grille cloth fitted to lesser quality units. The cabinet has a cubic capacity of 2.75 cu ft having sides 1" thick to stop any resonances that may occur. To top all this the crossover has roll-off of 12db per octave and includes a tone control to allow you to tailor the response to your room. Power handling capacity 50 watts RMS, frequency response 20-22000Hz. Our Special Direct Import price is only **$198.00** per pair. Freight $10.00 per pair.

For the economy minded we have the Model V100 which has all the features of the V120 except it has a 10" woofer plus 5" midrange and the same 1½" Dome tweeter in a 1.75 cu ft enclosure, and incredible power handling capacity of 40 watts RMS and a Fequency response of 20-20,000Hz. **$158.00 per pair.**
Freight $10.00 per pair.

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COLOUR ORGAN MODEL V3050

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Display Colours: Red, Yellow, Green, Blue, Violet.
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Operation: 240V 50Hz.
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POWER OUTPUT: 35 Watts R.M.S. per channel at 8 ohms (both channels driven).
DISTORTION: Less than 0.05% total harmonic. Less than 0.05% I.M.
FREQUENCY RESPONSE: 20Hz to 20KHz ± 0.1db.
Stable and ring free output into reactive loads up to 0.5uf KSA3500 the finest of quality.
$119.00 for Kit.
$140.00 completely built.
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UNBELIEVABLE

Have you ever tried to find a small extension speaker, small enough to fit anywhere in your room or car having a power handling capacity of 10 Watts R.M.S., a frequency and bass response to equal that of a 10 inch twin cone speaker, with an attractive decorator finish?

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Our little Cube speaker took 3 years to develop and has all the features you have been looking for in a small speaker, yet is fitted with an 8 ohm 5" full range speaker with voice coil throw of 1½". A bass response equal to that of a 10" speaker, a frequency response from 45 to 18,000Hz, achieved with a 3" magnet structure. All enclosed in a cabinet measuring only 6" x 6" x 6". Available in 3 decorator colours; black, red and ivory. This is the best small speaker value on the Market today at the incredibly low price of **$13.50**, P / Post $1.50.

DIGITAL FREQUENCY METER

This is a professional test instrument designed as a companion unit for the D.V.O.M. presented in October. It features high legibility L.E.D. readouts and an E.C.L. Prescaler to provide operation to 200MHz. Provision is also made for an overflow indicator and calibration outputs.
Frequency Range = 200MHz (with internal Prescaler)
Input sensitivity to 20MHz = 50mV
Input impedance to 20MHz = 1MHz / / 50 pf
Price — **$94.50**, Scaler — **$26.50** extra.
Pack / Post **$2.00.**

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SCOOP SO

Kit-Sets Aust have in a limited quantity only, the elusive MC1312 PSQ Decoding chips. These will be sold on a first come first served basis.

A Totally New Concept in Amplifiers Playmaster 140

As a follow-on to the exceedingly popular P.M.136, Electronics Australia have released the P.M.140. Using several different methods of decoding, it has similar specifications to its predecessor, with a power output of 13 watts R.M.S. per channel — a total of 52 watts.
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Let's talk about amplifiers (Part 3)

Elementary Electronics

by Ross Tester

In last month's discussion we dealt with amplifier output stages and, in particular, the complementary symmetry push pull system. This month we take up the story with the addition of a driver stage, the provision of negative feedback etc, and the eventual evolution of a completely practical amplifier.

Assuming the output stage is now firmly understood, we imagine the next question is "OK, how do you drive it? Where and how are the input signals fed in?"

Fig 4 last month showed the evolution of a bias network for a class B stage. In this idealised version, a resistor connected the positive rail to the base of the top transistor. You may have noticed that Fig 6 had a transistor replacing this resistor — and it is this transistor which is used to drive the output circuit.

This transistor is normally operated in class A, with some current flowing through it at all times. One way to look at this transistor is as a form of variable resistor — when it is biased well on it is a very low value resistor; when it is biased nearly off it is a very high value resistor.

Although the two transistor bases are separated by a bias network (diode and 100 ohm resistor) it is convenient to visualise the two bases and the bias network moving bodily in terms of voltage. Thus, if the driver transistor increases its conduction, the bases of both output transistors will move towards the positive rail. This will turn on the upper output transistor and turn off the lower one, effectively moving the junction of their emitters towards the positive rail.

Conversely, when the driver transistor becomes less conductive, both bases move towards the negative rail, turning on the lower one, turning off the upper one, and moving the junction of their emitters towards the negative rail.

A simple amplifier can be made in this form — a pair of output transistors, plus a driver transistor. However, it would be relatively insensitive, requiring a large amount of input voltage for full power output. In other words, the gain would be very low.

To overcome this difficulty, we use another transistor — a preamplifier. This preamplifier increases the input signal voltage, and feeds it to the driver transistor — with the result that full power is developed by the power amplifier with much less signal input.

The amplifier as presented has a basic sensitivity of around 300mV — quite sensitive enough to be driven by high output ceramic cartridges. Low output ceramic cartridges, such as the "Decca Deram," will not drive the amplifier fully, but a useful output will be obtained.

Now let us turn to the main circuit diagram (Fig 1) and examine it. There are a few components which we have not mentioned before, and which need to be explained.

Starting at the speaker and working back, we have the familiar output transistors, with their driver stage. There is one small alteration between this and the circuit shown last month — the bottom bias resistor (1.2k) does not go directly to the negative supply, but instead to the speaker terminal.

The reason for this is to shut the amplifier off should the speaker become disconnected. In this type of amplifier, open circuit speakers will not cause any damage (though this is not the case in some other types) but the lack of return path (through the speaker) for the bias current means that the amplifier will not waste any power. This is particularly important where batteries are used.

(In this amplifier, a short circuited speaker line will almost certainly damage either or both of the output transistors. While steps can be taken to ensure that shorted speaker leads do not cause a catastrophe, the cost would be prohibitive in a simple amplifier like this.)

The 1.2k resistor also contributes a small amount of negative AC feedback. However, almost all the negative feedback is provided by another "new" component, the 2.2k resistor from the emitters of the output pair back to the preamplifier transistor. We will have more to say about negative feedback a little later on.

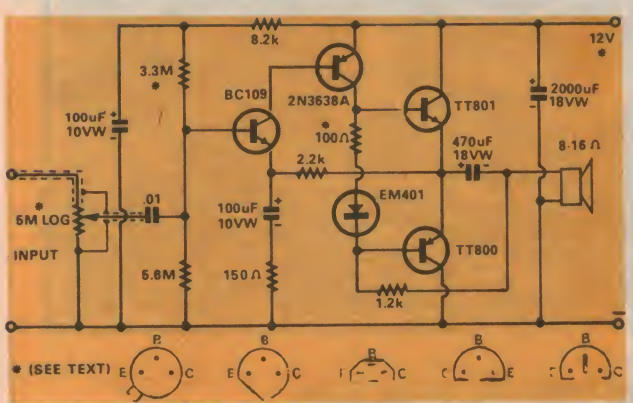
Ahead of the output stage is the driver transistor. As we mentioned, this is normally biased in class A and so draws current all the time. If a signal is applied to the driver transistor base, it conducts either harder or less hard, depending on the signal polarity (positive or negative going at that particular instant), and so changes the bias on the output pair.

By the same token, this driver transistor controls the operating condition of the output pair. Too much current through the driver transistor and the upper output transistor will draw more quiescent current than it should, and the lower one will draw less. If the driver draws too little current, the reverse will apply.

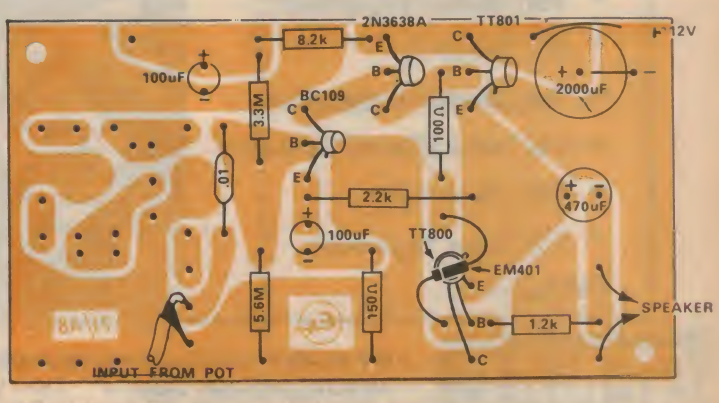
The current through the driver transistor is determined by the forward bias applied to its base, which comes, in turn, from the collector of the preamplifier stage. And, finally, the bias for this stage comes from a conventional bias divider network (3.3M and 5.6M) such as we described in the December issue.

Thus, this divider not only sets the bias for the preamplifier transistor and driver transistor, but also sets the operating conditions for the output pair. Note that we have placed an asterisk against the top resistor, with a note to refer to the text. This is because this value may require changing — particularly if you use a different supply voltage to that shown.

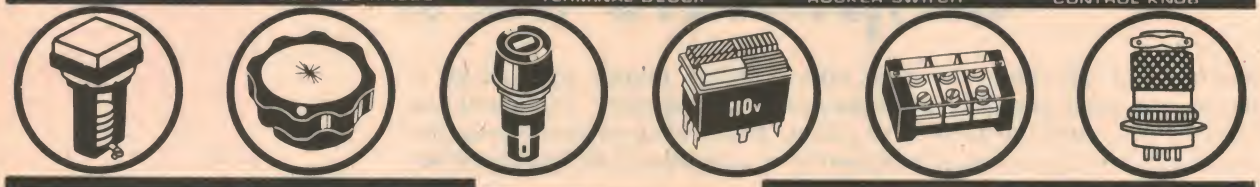
We used a nominal 12V supply, which is easily obtainable from a pair of 6V lantern batteries (Eveready 509), or by connecting



Here is the amplifier circuit. Take care with transistor configurations — even types with the same number may be different. Check with your supplier if in doubt.



***The** printed board pattern with appropriate connections, shown full size. The orange tone over the circuit corresponds to those compInents shown on the board above.*



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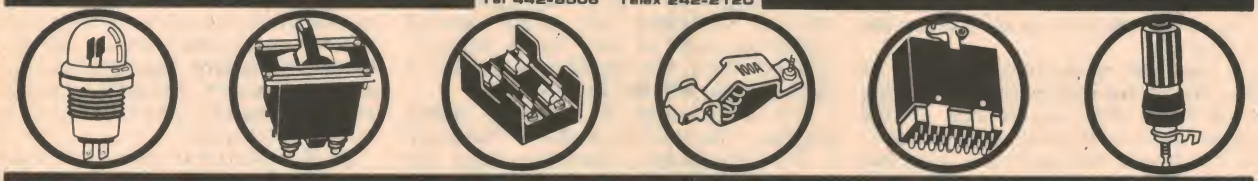

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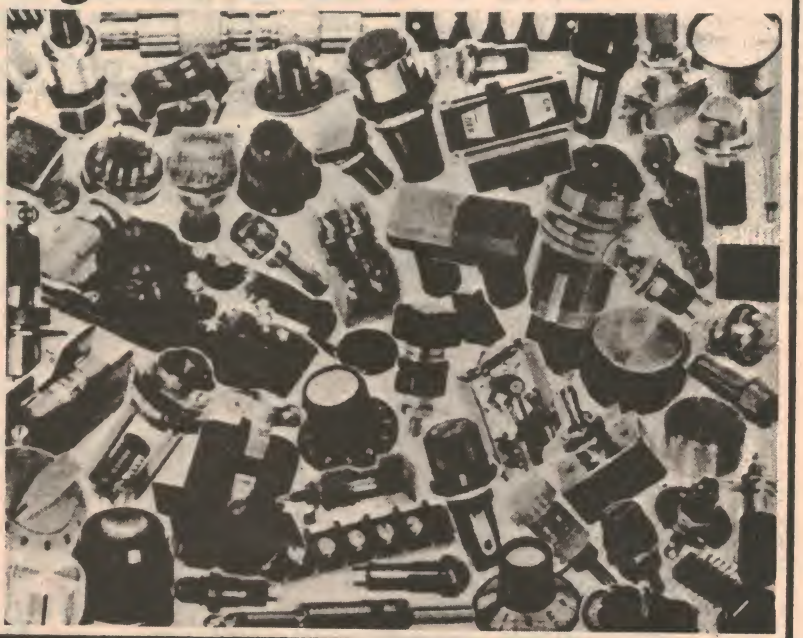

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the halves of an Eveready 2582 dual 6V battery in series.

The amplifier is most powerful on 18 volts (maximum permissible), delivering approximately 1½ watts into 8 or 16 ohm loads. (Lower value loads must not be used.) However, with a 12V supply, the amplifier still delivers close to a watt, which is more than adequate for most hobby uses.

In fact, if the supply voltage is increased, two components may need to be changed. One is the 3.3M resistor already mentioned, and this will probably need to be reduced in order to ensure a half supply voltage condition at the emitters of the output transistors. (More about this shortly.) The other component is the 100 ohm resistor in the output stage bias network, which may also need to be reduced. The final value should be that which gives the lowest quiescent current without obvious crossover distortion.

While on the subject of power, we might as well clear up some of the basic misconceptions associated with power levels and changes in power levels.

It is a common belief — and jn some ways an understandable one — that any increase in power will produce a proportional increase in loudness, ie, twice the power will sound twice as loud. This is completely wrong.

Without going into details we can state that a two-to-one power increase represents only 3dB (3 decibels), which is about the smallest change which the ear can detect — and then only if the listener is consciously listening for an increase. To produce an obvious change, on program material, something between 4 or 5dB would be required. A change from 1W to 1.5W represents only 1.7dB; indicating just how insignificant such small changes really are.

So if your friend in the guitar playing fraternity, tells you he is selling his 60 watt guitar amplifier and buying a hundred watt type, you can explain that he is wasting his money. No-one will be able to hear the difference! (It represents an increase of less than 2.3dB.)

An increase in power of 3dB or less is normally only worth attempting if it can be done without an increase in price.

The limit to the power output of this — or any — amplifier is the onset of serious distortion, normally due to "clipping".

A CRO is the ideal way to examine clipping. The top and bottom of the waveform are flattened — appearing, as you might expect, as if they had been clipped off. If the amplifier is set up and biased correctly, clipping will be symmetrical. If not, the clipping will occur on one half of the cycle first. To adjust this, the 3.3M resistor should be adjusted so that the emitters of the output transistors, with no input applied, are within half a volt of half the applied voltage. This is called the "midpoint".

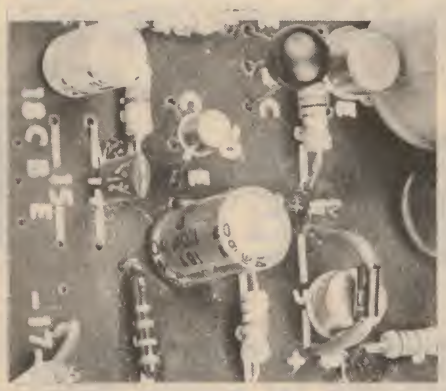
If the emitters are adjusted to the midpoint both transistors should conduct by the same amount in their quiescent (no signal) condition. When signal is applied, and each one conducts alternately, it should conduct by the same amount as its partner. Therefore both will overload at the same signal level, or clip at the same amplitude. Maximum power with minimum distortion is obtained this way.

The only components ahead of the preamplifier bias network are the input capacitor, preceded by the input potentiometer. This is shown as 5M and should have a logarithmic taper (it will probably be branded "5M C"). If you wish, this pot could also incorporate a switch to turn the amplifier on or off. While we have specified 5M, if you have something slightly lower, it may be used.

In fact, anything down to around 500k would be acceptable for most purposes, but if a ceramic cartridge is to be used, low frequency response will suffer with the lower impedance. Linear ("A") type potentiometers may also be used at a pinch, but there will be a very uneven pot position / loudness characteristic. They will not cause any problems electrically.

Earlier, we mentioned negative feedback, and promised a more detailed discussion. Negative feedback is used extensively in amplifier circuits to improve performance in a number of ways. It reduces harmonic distortion and improves frequency response, to name just two of its more important roles. In simple terms it consists of taking a small amount of the output signal voltage and feeding it back into some earlier stage in such phase relationship as to oppose (or tend to cancel) the input signal. The term "negative" indicates this phase relationship.

One result is to reduce the gain of the amplifier, since part of the input signal is cancelled. While a minor disadvantage, this loss can be allowed for in the basic design. What is more important is that any harmonic distortion generated within the feedback loop, ie, between the output stage and the stage where the feedback is injected, will be significantly reduced also.



This is a part of the printed board, showing particularly the mounting of the bias diode on top of the power transistor. (bottom right hand corner).

Similarly, any tendency for the frequency response to vary within the feedback loop will also be minimised. If the gain tends to rise at a certain frequency, the feedback voltage will also rise, effectively reducing the gain at that frequency.

There is another type of feedback, positive feedback, which has the opposite characteristics of negative feedback. This occurs when the feedback voltage is in such phase relationship as to aid the input signal. Positive feedback has no place in audio amplifier design, but is the basis of all oscillator circuits.

Another name for positive feedback is regeneration, and a good example is a regenerative radio receiver.

Even where an amplifier uses negative feedback, positive feedback can also occur. It may occur within the so-called negative feedback system, because the feedback does not remain negative at all frequencies, or it may occur via another (unintentional) path between output and input.

Amplifiers which use an output transformer, as do valve types, and include the output transformer in the feedback loop can experience the former problem, the transformer often exhibiting a phase reversal at very high or very low frequencies. The result can be either supersonic oscillation, or very low frequency oscillation (motorboating).

Other positive feedback paths can also favour the very high frequencies or the very low frequencies. Capacitive coupling between input and output leads running close together is a simple example of unwanted high frequency positive feedback, while coupling through a common power supply is a typical example of unwanted low frequency positive feedback.

Very careful circuit design, wiring pattern design, and physical layout is often needed in high gain amplifiers to keep these unwanted factors under control.

There are various types of supersonic oscillation. An amplifier may oscillate in its quiescent state, or only when being driven. It may oscillate only when handling certain frequencies, making it very difficult to track down. One form of supersonic oscillation shows up on an oscilloscipe as a "pocket" of fuzziness on an otherwise clean waveform. Others may show as a broad band of fuzziness, only coming clear when the CRO timebase is set to a relatively high frequency.

Another form of negative feedback is called "DC negative feedback", as distinct from that which we have been discussing which, strictly, should be called "AC negative feedback". DC negative feedback is usually used to stabilise the DC or quiescent current conditions of an amplifier, which may otherwise vary with temperature, or from unit to unit due to spread of components.

In this amplifier, we provide both AC and DC negative feedback. The feedback network consists of the 2.2k resistor (emitter junction, output transistors), 100uF capacitor (preamplifier emitter), and the 150 ohm resistor (negative rail). We will consider the DC feedback function first.

Earlier we emphasised that the operating conditions of the output transistors — particularly their correct "midpoint" operation — was determined by the current through the preamplifier transistor. Since there is considerable gain between the preamplifier and the output stage, it is easy to appreciate that a small change in preamplifier current will have quite a large effect on the balance of the output pair. Thus, temperature changes within any one unit, or component spreads from unit to unit, can easily upset this balance.

It is the job of the DC negative feedback to minimise this effect. Let us assume that an initially balanced condition is upset by a temperature increase which causes the preamplifier current to increase. This will cause the driver transistor current to increase also, moving the output transistor bases towards the positive rail, and the junction of their emitters in the same direction.

Now, since the preamplifier emitter is coupled to this junction via the 2.2k resistor, this emitter will also move towards the

positive rail. And, since the voltage on the preamplifier base is held essentially constant by the divider network, this shift in emitter voltage constitutes a reduction of forward bias. Hence, the preamplifier draws less current and the balance between the output transistors is maintained.

Note that a negative feedback circuit can never fully compensate for an error generated within its own feedback loop. Complete correction implies total elimination of the error signal — in which case there would be nothing to initiate the correction procedure! But it can reduce the error to a very small fraction of what it would otherwise be.

The DC negative feedback system just described uses virtually all the DC voltage error available at the output stage in order to make the scheme as effective as possible. The loss in the 2.2k resistor is negligible, and this is the only component involved. Since this system involves only the DC operating conditions, and has no effect on the gain of the system, such an arrangement is perfectly logical.

The AC negative feedback system is a rather different proposition. Here we have to strike a compromise between as much feedback as possible in order to reduce distortion and as little as possible in order not to reduce the gain by too large a factor.

The AC circuit uses all three components. As before, the output signal is taken from the junction of the output pair emitters, via the 2.2k resistor. The difference is that the 2.2k and 150 ohm resistors form a voltage divider, so that only a small proportion of this voltage — that appearing across the 150 ohm resistor — is actually fed back. The capacitor is used simply to isolate the 150 ohm resistor in the DC sense and prevent it from upsetting the DC feedback system already described. Provided its impedance is low, relative to 150 ohms, at the lowest frequency to be handled, its effect can be ignored.

As the output voltage swings alternately positive and negative, the emitter of the preamplifier moves with it, though over a smaller range. The phase of this voltage is such as to oppose the signal voltage applied between the base and emitter, thus constituting negative feedback. The amount of feedback is small, in order not to sacrifice too much gain, but is nevertheless useful.

Construction of the amplifier is simple; we have specified a printed wiring board which should eliminate any chance of wiring mistakes. Start construction by mounting the resistors and the two small capacitors on the board.

Next, fit the output capacitor and the other small electrolytics. Leave the 2000uF for the time being. Fit the BC109 and 2N3638A, taking note of lead connections, then the output pair (TT800, TT801), leaving the leads about 1cm long.

The EM401 bias diode is mounted in a special way. Leave the leads long enough to allow it to be mounted above, and in contact with, the top of the TT800 transistor.

In this way it is able to monitor any changes in the transistor's temperature. If the diode is heated, it conducts harder, reducing the bias. This causes the TT800 to conduct less hard — thus reducing the temperature and preventing thermal runaway.

This is another form of feedback — by monitoring the heat level and acting on it the diode is performing a type of DC feedback — not affecting the signal, but keeping things from getting out of hand.

Naturally, the leads must be insulted from the case of the transistor. The easiest way to do this is to use some PVC covering from hookup wire as spaghetti.

Once the diode is mounted, the 2000uF capacitor can follow. At the time of writing, 2000uF printed board mounting capacitors were in very short supply, so we had to use a normal pigtail type, and bend one of the leads over so that it stands on end. You will probably have to do the same, unless the supply situation improves in the meantime.

Once again, it is a good idea to cover any bare wire with spaghetti to prevent shorts. The output leads (to the speaker) and the power leads can be soldered on next.

The signal input lead should be shielded, as any other type of lead may introduce unwanted noise, particularly hum, into the amplifier. The lead from the signal source to the potentiometer should also be shielded for the same reason. When soldering shielded lead, take care not to damage the insulation with too much heat. If this occurs, there can be much weeping, wailing and gnashing of teeth later on, when you try and find why the thing doesn't work.

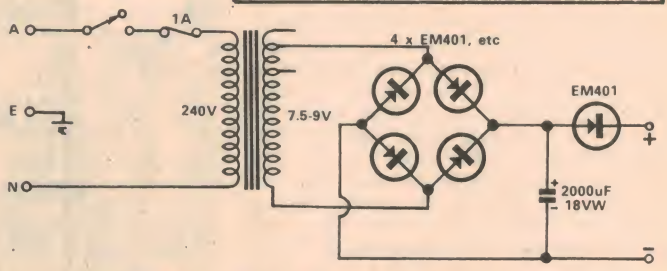
While on the subject of parts, we might try to dispel some fears which many readers have expressed in letters. If the circuit calls for a 2000uF capacitor, and your dealer says "Sorry, have to give you a 2200 or 2500", don't think he is giving you a raw deal. Rather, you are getting the better type. Electrolytic capacitors have a tolerance of (usually) +100% and — 50% — so you can see there is a very wide range.

Also, if the circuit calls for an 18V type, and he offers a 25V type, take it — it is quite in order to use higher voltage rated components, providing they fit! Another frequent bone of contention is with the EM4 . . . series of power diodes. We might specify an EM401 — but they get an EM402, 404, 408, 410, etc. Once again, this is quite in order. Providing the number is higher than that specified, it means the PIV rating is higher — and is quite acceptable — perhaps even better.

We have not mentioned the speaker as yet — this is left to the reader. You may use a good quality speaker box, or a "junked" speaker which came from an old radio receiver, etc. Either will do the job, but naturally you can expect superior results from a properly baffled and enclosed speaker than from one which is just sitting

PARTS LIST

SEMICONDUCTORS
1 BC109
1 2N3638A
1 TT800 / TT801 pair
1 EM401 diode
RESISTORS (10% ½ watt)
1 100 ohm
1 150 ohm
1 1.2k
1 8.2k
1 3.3M
1 5.6M
1 5M long pot (see test)
CAPACITORS
1 .01 polyester
2 100uF / 10VW electrolytic
1 470uF / 18VW electrolytic
1 2000uF / 18VW electrolytic
MISCELLANEOUS
1 Printed board 71⅞a8
hookup and shielded wire, solder, etc.
POWER SUPPLY
1 Eveready 2582 dual 6V battery
1 connector to suit
OR
2 Eveready 509 lantern batteries connected in series
OR
1 power transformer (7.5 to 9V & 1A)
5 EM401 diodes or similar
1 2000uF 18VW electrolytic capacitor, mains cord & plug, fuse & holder, suitable case, hookup wire, etc.



This power supply will give a nominal 12V DC with 8.5V AC input. Exceeding 9V input may cause thermal runaway.

in mid-air.

Whatever you decide to use, check first to see if the impedance is correct. Many speakers have the impedance stamped on them. If so, fair enough. But if not, check the resistance with your multimeter. This will not be the same as the impedance but it will be close enough for our purpose.

Use a low ohms range and if the meter reads around 5-6 ohms, you have an 8 ohm speaker. If around 10-12 ohms, the speaker is 15 or 16 ohms. If the reading is lower than 8 ohms, the speaker should not be used (damage may occur). If it is significantly higher than 12 ohms, it can be used if you are prepared to put up with some loss of output power.

The amplifier may be placed in a case or box, but we will leave any decision on this to the reader. Choice of power supplies is also open — but the batteries already mentioned would be logical in view of their initial lower cost. If you wish to use a mains supply refer to the circuit diagram given and also our article on power supplies in Elementary Electronics from February to April 1973 for more information.

In order to prevent any feedback through the power supply, we have included a silicon power diode (EM401 or similar) between the power supply capacitor and the capacitor on the printed board. Such a diode effectively isolates the supply from the amplifier.

Finally, we must set up the amplifier: First, measure the supply voltage (it should be around 12V). Then measure the voltage between the output pair emitters and the negative supply. It should be within half a volt of half the supply voltage. Then measure the overall current drain from the batteries with no signal applied. It should be somewhere between 10 and 20 milliamps. If it is outside these limits, adjust the value of the 100 ohm resistor — lowering this resistor lowers the current, while increasing it increases the current.

If you have a signal generator and CRO at your disposal (school students especially) connect the generator to the input and the CRO across the speaker. Turn on, and set the generator to, say, 1kHz.

You should see a clean, even waveform. No nicks, no fuzziness, no distortion. If so, you are half way home. Wind the volume control up and watch the screen. The top and bottom of the waveform should begin to distort at the same time — not a few degrees after each other. If this is not so, re-check the emitter voltage for half supply value.

The final check is to see that the amplifier does not suffer from thermal runaway. Leave the amplifier turned on for, say, half an hour, monitoring the current drain during this period. (No input should be connected). If the current appears to stabilise and not rise above, say, 50mA, the amplifier should not suffer from thermal runaway. But if the current is this high, it is wasteful, particularly if batteries are being used.

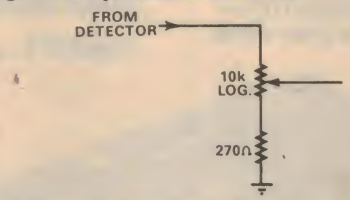
To reduce the current reduce the value of the 100 ohm resistor. The correct value is the lowest possible without producing corssover distortion — monitor this either by ear or with a CRO. A current of 15mA will probably be close to the mark.

Assuming everything has worked without any problems, the amplifier is now finished and can be put into its case (if desired) and the input connected. As we said, the input should really be a high output ceramic cartridge — the amplifier needs a few hundred millivolts of drive.

Elementary Electronics Ideas Worth Trying

Battery Protector

Have you ever turned your portable radio volume control right down, then left it running for long periods because you forgot to turn it off? If you have, you probably flattened the batteries, or at least wasted a significant portion of their life.



A simple protection against this risk is to fit a small amount of resistance in series with the common end of the volume control. This allows the volume to be turned to a low level, but never right off. The minimum level should be kept as high as possible, to make the idea effective, but not so high as to be inconvenient in quiet listening situations. Values between 2pc and 3pc of the volume control value generally work out satisfactorily, but this can be varied on a trial and error basis.

(S.L., Collaroy, NSW.)

Parts Dispenser

When building projects, particularly from a prepared kit of parts, a lot of time is often wasted finding small parts or particular values of resistors and capacitors, as the job progresses.

A simple solution to this problem is to obtain a flat piece of "Styrofoam" such as used for packing material, and fix a sheet of white paper on top of it. Then push the pigtails of the resistors, capacitors, transistors etc through the paper into the foam, and write the values or type numbers alongside them.

This technique enables individual parts to be selected very quickly, and project building time is greatly reduced.

(Mr C. Cave, 51 Turramurra Avenue, Turramurra, NSW, 2074.)

Coil Formers

For low power use in amateur transmitters etc, plastic pill bottles available from any chemist make ideal coil formers. They come in a variety of sizes and diameters, and the smaller ones have a small enough ID to the use of ferrite slugs quite practical.

Plugs, available in many pin configurations, can be cemented to the base of these bottles to make plug-in coils. Alternatively, the coils may be cemented to a chassis or wiring board with epoxy cement.

(George W. Smith Jr, W5HIP / W5DPJ.)

Preprinted from QST, June 1973.

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Reviewed by Julian Russell

Busoni's Dr Faust — At last!

BUSONI — Dr Faust. Complete Opera. Diedrich Fischer-Dieskau (Faust); Karl Christian Kohn (Wagner); William Cochran (Mephistopheles); Amton de Ridder (Duke of Parma); Hildegarde Hillebrecht (Duchess of Parma) and others with the Choir and Orchestra of the Bavarian Radio conducted by Ferdinand Leithner. DGG Stereo 2709 032. (Three Discs).

Ferruccio Busoni was born during the 1850s and lived through to the end of the first quarter of this century. This means that he lived and worked during one of the most important transitional periods in the history of music. It was the age of such innovators as Debussy and Schonberg and such musical giants as Mahler, Richard Strauss, Verdi, Puccini, Elgar and others.

During his lifetime he received respectful attention as a composer but the austerity of most of his music won him very few real devotees. Today if he is remembered at all it is paradoxically by his transcriptions of pieces by Johann Sebastian Bach, which he rearranged to be presented with all the resources of colour and technique possible on a modern concert grand piano. I wrote "paradoxically" because today such transcriptions are frowned on by modern fashion. Today's musicians are more preoccupied in trying to recreate the sound as it was in the composer's day.

Busoni himself was one of the finest pianists of his day and the Bach-Busoni pieces demand a terrific technique, not of the showy kind, but of the type that can spread interest throughout the whole wide range of piano sonorities. Although a man of the romantic 1800s, he was one of the first of his generation to remain uninfluenced by the music of Wagner.

Busoni's idols were Bach and Mozart. He admired Liszt's pianism but not the Liszt of the Faust Symphony, the piano concertos or the numerous tone poems. He was born in Italy the son of an Italian father and a German mother, but spent most of his adult life in Germany where he received the greater part of his musical education. This dual nationality was to tug at him for the whole of his life.

In the words of the distinguished German critic, K. H. Ruppel — I had the pleasure of meeting him in Hamburg and Munich during the early 1960s — who provides the perceptive notes in the brochure that accompanied the boxed set:

"Busoni's mixture of Italian and German blood qualified him for a task unique among all his contemporaries — the fusion of Germanic spiritual and Latin formal traditions on the basis of inborn classical feelings on the one side and strong learning towards modernity on the other."

Although Busoni was never less than bold in his use of "new" harmonies he forsaw the anarchy that would be introduced into music by Schonberg and his disciples. I have not the space at my disposal to set out Busoni's 1906 draft of "a new aesthetic of music" but in view of the type of his composition under review here I think his opinion on opera in general might be well worth recording.

"Opera", Busoni wrote, "should adopt the supernatural and unnatural as the only regions of experience and feeling appropriate to it, and should create on this basis a world of appearances which reflects life either in a magical or comically distorting mirror, intentionally presenting something not to be found in real life."

This was not only the formula he himself used in Doctor Faust, it was also significantly prophetic of the operas of many of the composers who have since followed him. It would be fascinating to speculate on the germ of the idea implanted by Mozart's Magic Flute and its progress through Maeterlinck's twilight world of Debussy's Pelleas and Melisande to Strauss' Woman Without a Shadow, and only recently, Penderecki's Devils of London. Such a journey would inevitably include a visit to Dr Faust.

Busoni incorporates some of these views in an address spoken by the "Poet to the Audience," not recorded in this set but included in the accompanying libretto. In this he reveals that he went for his libretto — which he wrote himself — not to the Faust legend of Goethe but to an earlier puppet play.

I could go on for a long time about the many oddities in Busoni, a man of undoubted genius who never quite realised his great creative promise, but I had better instead get on with some information about the opera and its recording. By the way it has been available for some time in Australia — it must have been issued here during one of my overseas trips — but I only came across it by accident when I was allowed the privilege of browsing through the stock of Phonogram Ltd, the Australian distributors of Philips, DGG and many other recording companies.

The form of the work will probably seem as strange to you as some of the sounds in it. It begins with a symphonia depicting the eve of Easter and the burgeoning spring. This over the Poet makes his address, not recorded but which can be read in an excellent translation in the libretto. Then follow two prologues, in the first of which Faust comes into possession of a rare book of magic, and in the second, with the aid of this book he summons up a succession of demons, only to reject them as useless, until Mephistopheles appears and Faust signs with him his now universally known bargain.

Another minor surprise is that the role of Mephistopheles is written for a very high tenor, and not the usual bass or bass-baritone.

The story continues with only the slightest of resemblances to the Faust of Gounod with its sentimental love story and the clash of evil and innocence. It is full of really chilling episodes symbolism used freely and music that is always interesting if it seldom beguiles.

It is an austere work, that does nothing to woo one. It is immensely difficult both to cast and to stage, and for that reason on the rare occasions it is presented at all it is in concert form.

The recording under review was made by a happy combination of circumstances — a production for the Bavarian Radio on behalf of the European Broadcasting Union, with finance enough behind it to engage a cast of memorable quality. In fact except for the only female in the cast, Hildegarde Hillebrecht, who is not happily cast as the young Duchess of Parma, the rest of the ensemble is ideal. The leaders are Fischer-Dieskau, using his fine voice and great intelligence as Faust, and William Cochran in the literally fiendish high tenor role of Mephistopheles. The chorus, an always important element in this opera, is consistently fine, and the orchestral playing of the first quality, a feature matched by the engineering.

There must be many like me who have been waiting for years to hear this masterpice. Whether or not it comes up to the expectations of all is difficult to predict. But it is a work that no student of opera can afford to ignore.

★ ★ ★

BERLIOZ — Benvenuto Cellini. Complete Opera. Nicolai Gedda (Cellini); Giacomo Balducci (Papal Treasurer); Robert Massard (Pieramosco); Roger Soyer (Pope); Derek Blackwell (Cellini's Foreman); Robert Lloyd (Bernardino); Hugues Cuendo (Innkeeper); Raimund Herincx (Pompeo); Christiane Eda-Pierre (Teresa); Jane Berbie (Ascanio) and Janine Reiss (Columbine). With the BBC Symphony Orchestra and the Chorus of the Royal Opera House, Covent Garden, conducted by Colin Davis. Philips Stereo 6707 019. (4 Discs).

Here is another work that even the most dedicated opera goer might be lucky to see staged once in a lifetime. Its chequered history is given in an admirable article by David Cairns in the brochure-libretto that accompanies the boxed set.

Briefly it sets out that the opera was designed as an opera comique, ie, one with spoken dialogue, which when refused by the Paris theatre of that name had the dialogue changed to recitatives for the Paris Opera, where it was presented to receive one of those Tannhauser-Sacre du Printemps types of reception for which that capital had once been famous.

Strangely — as a side comment — the invention of the Yale lock has to some extent interrupted this type of demonstration, because in the pre-Yale days gentlemen could create quite a shrill whistle by blowing down the barrel of one of the largest keys in his pocket. But that's by the way! At any rate, Benvenuto Cellini had a short run

at the Opera and was then put aside — and nearly forgotten.

It was rescued from oblivion by that great-hearted champion of worthy but neglected music in the 19th century, Franz Liszt, and put on by him in Weimar after a correspondence in which Liszt suggested major alternations to Berlioz who complied, rather as a means of getting the opera on than from any great conviction that Liszt's ideas were better than his own. Weimar also saw the publication of a score with the original spoken version returned to the spoken dialogue form in which it first appeared.

Which version to use? Cairns sets all this out lucidly in his article and one has perforce to agree with him in his support of the choice made by the record's producers. In these days of what might be called the search after true sound — Bach as played on a small organ, Scarlatti on a harpsichord, double-dotting, the still unsettled question of period decoration, and so on, opera has not escaped the trend. We have seen and heard "original" versions of Carmen, Tannhauser and other operas.

Some of the last named genre have been successful in their virgin version, others less so. I don't see how anybody with an ear could ever prefer the Dresden version of Tannhauser to the later Paris revision, though Carmen, rid of its mediocre added recitatives, has a clean scrubbed sound and increased drama that I find infinitely preferable to the Opera Comique version with its tarted-up interpolations.

However the version presented in the set under review is essentially a sane one giving credit to Berlioz for second thoughts when he was uninfluenced by outside pressure, reshaping the libretto which has been abominably twisted out of shape on various occasions, and generally leading up to the quite marvellous "casting" scene at the end of the opera.

Even those who adore Berlioz and hate to see a note of his changed will, it seems to me, have to admit that there is much about the opera that is musically uneven, the inspired composer yielding to the musical fashion of the period in order to introduce originality elsewhere, on a scale that shocked — and horrified — audience and performers alike. Indeed to many of the musicians of the period much of the music was unsignable and unplayable, hence its neglect even after the influential patronage of Liszt himself. However modern stage resources and musical techniques have now been able to solve all the relevant problems, and the opera as presented on this set can be described as a great success. This remark must be qualified here and there, but generally speaking I find it difficult to imagine the opera being done better.

The story tells of the successful casting in bronze of a statue of Perseus holding the severed head of Medusa, which serves as the climax of the opera, interspersed by a love theme and bits of comic business that lead up to it. This casting scene is also the highlight of the recording with everyone — chorus, principals and orchestra — responding nobly to the inspired direction of Colin Davis.

Despite its abounding energy and complex writing it has magnificent clarity. It is therefore all the more disappointing that the Roman Carnival scene, to which anyone with even a tyro's knowledge of the work would inevitably look forward, is less clear and its energy not quite so well focussed. About the whole recorded treatment of this scene, when those involved are considered, I can only offer the word inexplicable — and leave it at that, so as not to put you off acquiring a set that has so many other merits.

Again owing to the tyranny of available space I must close a little hurridely by commending, on the whole quite heartily, the cast of principals, and urge all those old admirers of Berlioz, and the growing number of new ones, not to let this historic recording slip out of their hands.

★ ★ ★

MOZART — Sonata in D Major (K 448) for two pianos — four hands. Sonata in C Major (K 521) for piano duet. Christoph Eschenbach and Justus Frantz (pianos). DGG Stereo 2530 / 285.

These two young Germans — and DGG — offer something closely approaching novelty by Mozart — his only work for piano duo — that is for two pianos — each having its own soloist. Mozart did, however, write five piano duets — for one piano played simultaneously by two pianists. One of these is included in the disc under review.

The Duo Sonata is a fascinating work. Some of its first movement is in canon form, of the most mellifluous kind. Often this device sounds a little contrived, with some of the notes which maintain a strict imitation of the preceding ones in the previous bar tending to force a natural sounding line a bit out of shape. But here it is all as natural as good conversation, which it often resembles in its question and answer type of dialogue.

It is played in perfect Mozart style by the young men whose photos appear on the back of the sleeve. It is a happy work, with the contrasting sonorities or instrument explored long before they attracted the attention of less inspired composers.

The slow movement might best be described as serenely nostalgic, like writing a letter to a loved one who is not too far distant. No outbursts of passion occur in this example of gentle, unruffled, returned affection. The final Rondo, if you want to be fanciful, could quite easily represent a happy reunion of the correspondents in the previous movement. It starts with a theme very reminiscent of the Turkish March in Seraglio. In the Subsidiary themes the moods change instantly from one kind to another but the general effect still remains light hearted.

The Piano Duet used to be a popular form of music making at home before the advent of the gramophone and player piano. Orchestral works were, if considered successful, always brought out in arrangements for piano duet — as well as, of course, piano solo. It will be readily recognised that four hands can play twice as many notes as two — an important factor in transcribing an orchestral work for performance on a single instrument.

In the first movement of this duet, under a quite hidden disguise of extreme simplicity, Mozart introduces a multiplicity of subtleties. The first movement stretches over a longish period, but its many ingenuities successfully ward off any tendency to boredom. This is followed by an idyllic Andante in F Major that has a middle section in D Minor. I mention these keys because the latter is the relative minor of the former and in normal circumstances should not be expected to produce a sudden punch in its contrast. Yet, inexplicably, as

used here by Mozart, its dramatic effect is as startling as a first thunderclap. In it you will recognise one of the seeds of the Romantic movement that flowered soon after.

In the final Rondo the first subject sounds artificial, deliberately coy at first but becoming more and more sophisticated as the movement goes on, producing a quite marvellous blend of the two that was, one is tempted to feel, mischievously done. The lucent quality of the writing in both works and its presentation with complete understanding by the two fine pianists make this an entierely irresistible disc to me.

★ ★ ★

DEBUSSY — Preludes, Books 1 and 2, 12 preludes in each book. Dino Ciani, Piano. DGG Stereo 2530 304 and 2530 305.

This 32-year-old Italian pianist's name was unknown to me until these two impressive discs turned up. According to the sleeve notes, Ciani was a pupil of Cortot, so that it is not surprising to hear from him the most careful contrasting of sonorities and dynamics. Indeed each of these Preludes might be said to have its acoustic key as well as its usual musical one. Thus the tone Ciani produces in the stately "Delphic Dancers" is utterly different from the guitar-like twangs in the "Interrupted Serenade" and the organlike note of the famous "Sunken Cathedral."

He takes the Delphic Dancers in almost strict time, varying only his touch with commendable subtlety. It is all very grave, without pomposity and the strictness of its discipline is a joy after listening to the mutilation and splashing that some pianists, quite wrongly, think is what Debussy had in mind about "impressionism."

The second piece in the first book is Voiles, a piece mostly in the whole-tone scale unfamiliar to most of its hearers when it was first played. This visionary piece of atmospheric writing is not all played with the commonly held idea of "two-pedal" Debussy, though, when necessary this technique is quite effectively used. When the climax arrives the tone wells out and the scales run as smoothly as mercury. Yet it is all intensely masculine — as was its composer.

No 3, "The Wind Across the Plain" is a stark little piece offering wind but no shelter from it. A splendid contrast to its predecessor.

No 4, roughly translated as "Sounds and Scents Are All Around in the Evening Air," is full of sensuous delights, a rapt recollection of a quite bewitched evening. The whole prelude is dominated — if that is the word — by nocturnal murmurs. The piano sound is everywhere completely faithful.

No 5, the Hills of Anacapri, offers a brilliant contrast in its white, midday sunshine on this Mediterranean island. But Ciani doesn't dash at it, doesn't dazzle us by taking us straight from the dim outlines of the previous piece straight into eye-hurting light. First he sketches in an outline of the form, and only after having done that does he pour out the near blinding radiance of this southern sunshine.

No 6, "Footsteps in the Snow", is a study of the loneliness of a winter landscape. Lonely and nearly soundless. Birds are silent as the traveller's footsteps move almost stealthily over the tick-pile snow carpet. Here the only comfort is solitude, the only movement that of the traveller.

No 7, What the West Wind Saw, gives Ciani the chance to display the brilliance of his technique. I'm not sure just what it was the wind saw, but it races past it with irresistible energy.

We now come to the famous "girl With the Flaxen Hair", a portrait of a young girl as fresh in sound as a Renoir in paint.

In No 9, "Interrupted Serenade", you will hear a quite wonderful imitation of the sound of a guitar. There is the ghost of a distant melody before the main part of the serenade begins. This is a good example of the attention to detail to which Ciani pays such assiduous attention during the whole recital, without ever making his playing sound pedantic. Indeed his presentation of these two books of Preludes makes one hope he will get around to recording the Etudes, too. While there are many sets recorded of the Preludes, the Etudes have not been nearly so lucky. In fact mine date back to the old Gieseking issue.

For instance, we now come to No 10 in the first book, The Sunken Cathedral, which has been recorded countless times both on its own and in complete recordings of the Preludes. The playing of it you hear from Ciani will not disappoint the most critical among you. Personally I have heard none better and very, very few as good. Ciani — and, of course, Debussy — combine mystery with solemnity in one of music's most vivid evocations.

Puck (No 12) is at once cheeky and fairylike. I would perhaps have liked to have heard it made just a thought more mischievous. Here you can well imagine him putting a girdle round the earth in 40 minutes, but not his playing of ill-natured tricks on lovers and others. The piece was extraordinarily popular for many years, and still is, though connoiseurs would perhaps go to the Puck of Gritten's Midsummer Night's Dream, where he is drawn in flashes of trumpet fire.

The last Prelude in Book 1 is Minstrels, a piece that has been transcribed for many other instruments but which is still heard at its best in its original form as a piano solo. It is full of clown like tumbling, wide-mouthed grins, and, quite rightly, a touch or two of sentiment — because under every clown's exterior beats a heart . . . you know the rest.

I have reviewed Book 1 in such detail to give you a general idea of the range of Ciani's interpretative powers and technical equipment. The Book Two 12 Preludes are played with the same skill and elegant taste. The preludes range over the same vast range of moods and evocations as the first. There are the same sudden yet effective contrasts the same inspired allusions. Some move as intangibly as mists, others dance like faries and a few are rich in knockabout humour. In case you don't remember, the 12 consists of: Brouillards; Feuilles Mortes; La Puerta del Vino; Les Fees sont D'exquises Danseuses; Bruyeres; General Lavine — eccentric; La Terrasse des Audiences du Clair de Lune; Ondine; Hommage a S. Pickwick Esq; Canopes; Les Tierces Alternees; and Feux d'Artifice.

In our next issue I shall be reviewing some piano records by that elusive master, Arturo Benedetti Michelangeli, who also plays some Debussy.

Variety Fare

Reviews of other recordings

Devotional Records

MUSIC OF INSPIRATION: Harold DeCou at the Allen Computer Organ. Stereo. (From Mackay Electronic Distributors Pty Ltd, 32 Woodhouse Rd, Doncaster East, 3109. $5.00 posted).

Over the years I have reviewed a great many "inspirational" organ records, in a lot of cases without any great enthusiasm. Electronic instruments have often sounded inappropriate while, with the popular pipe instruments, there has been an evident struggle with the mechanical attributes.

In this album Harold DeCou has everything going for him, with an organ that has all the ease and versatility of a modern electronic, with a sound that is completely pipe-like in its quality. In fact, the instrument can be programmed to duplicate the choicest ranks of any instrument(s) that are accessible for electronic analysis.

And it is evident that Harold DeCou thoroughly enjoyed the experience. He comes up with new arrangements of old hymns that will intrigue, while also allowing him to demonstrate the potential of the instrument: Calling — The Old Rugged Cross — Bless This House — When The Roll Is Called Up Yonder — Ivory Palaces — No Longer Lonely — Something For Thee — Only A Few More Shadows — Heartaches — Count Your Blessings.

If you have any interest at all in these hymns and the revolutionary new Allen organ, this album will be well worth the purchase price. (W.N.W.)

★ ★ ★

HYMNS AND ANTHEMS. The Fountain St Church Choir, directed by Beverly R. Howerton with Donald L. Westfield at the Allen System 900 3-manual organ. (From Mackay Electronic Distributors Pty Ltd, 32 Woodhouse Rd, Doncaster East, 3109. $5.00 posted).

Performed by a long established Baptist choir, in a Catholic church in Grand Rapids, Michigan, this is an excellent devotional album in its own right. The music is varied but likely to find wide appeal: All Glory Laud and Honour (Schreiner) — When I Survey — Immortal Invisible — Drop, Drop, Slow Tears (Graham) — Grant Me True Courage, Lord (J. S. Bach) — We Are Searching (Kimmel) — Adeste Fidelis — Abide With Me — O God, Our Help In Ages Past — The Eyes Of All Wait Upon Thee (Berger) — Amazing Grace.

So much for the music but, inevitably, attention will be focussed on the organ, the radically new $20,000 Allen Digital Computer Organ. There is little practical point in debating how it sounds. In its interplay with the choir, it has all the qualities of a massive pipe organ, beautifully voiced, but capable of sensitive control and very well played. Without seeing the jacket I doubt that anyone could pick it as an electronically based instrument, unless on the basis that its qualities are more than one would expect in the recording situation.

But, as if to underscore the point, the organ which has been so richly classical in all the preceding tracks is transformed for "Amazing Grace" into a gently swinging instrument with voices ranging from a pipe Wurlitzer to a conventional electronic. Fascinating, and another excellent $5.00 worth! (W.N.W.)

★ ★ ★

THE OLD RUGGED CROSS. Wayne Newton. Stereo, Capitol series 299, SENC-10050.

If memory serves me correctly, this is a budget-price re-issue of a recording released about the time when Wayne Newton first visited Australia. He was a notably boyish rising star, mild-mannered and idealistic and this is the personality that comes through on this album. No "with it" sound here; they are "mature" songs sung in the way that mature people might judge that they ought to be sung!

The Old Rugged Cross — It Is No Secret — Somebody Bigger Than You And I — Who At My Door Is Standing — The Gifts Of God — Whispering Hope — Just A Closer Walk — What A Friend — Rock Of Ages — Take My Hand, Precious Lord — The Power Of Prayer — The Lords Prayer.

Reaction to this album will be strongly personal. Pick any track that appeals to you and decide for yourself. (W.N.W.)

★ ★ ★

A CEREMONY OF CAROLS, also Hymn to St Cecilia and Missa Brevis (Benjamin Britten). Kings College Choir, Cambridge. Stereo, His Master's Voice HQS 1285.

This record was received too late to be reviewed for the December issue, but it is worth noting, as its appeal is by no means restricted to the Christmas season. It can be listened to with pleasure throughout the year, particularly when performed with such excellence as here by one of the world's leading choirs. The Ceremony of Carols consists of settings of nine mediaeval or renaissance tunes, replete with the special kind of beauty which the Christmas story has always inspired in composers.

The Hymn to St Cecilia, a setting of a poem by W. H. Auden, is entirely Britten's creation, written in 1942, but its sustained beauty is quite out of character with modern music. The Missa Brevis, composed in 1959, is, according to the sleeve note, "a direct descendant of the Ceremony of Carols." To my mind, it is too dramatic for liturgical use, but as a concert item it is splendid. A disc with perhaps specialised appeal, but if your taste lies in this direction, it should give intense pleasure. The recording is fine, and it is worth noting that EMI has issued the disc on their medium price HQS label. (H.A.T.)

★ ★ ★

SELECTIONS FROM "THE MESSIAH" (Handel). Soloists with the London Symphony Orchestra and Chorus, conducted by Leopold Stokowski. Stereo, Decca SPA 284.

Every year, just before Christmas, records of "The Messiah" are released, usually of the "highlights" type, as in this disc, offered on Decca's low price "World of the Great Classics" series. It has all the usual tracks one expects to find in a selection from the work, including Every Valley — And the Glory of the Lord — Why do the Nations — Hallelujah Chorus — I know that my Redeemer — Amen Chorus, etc. The very competent team of soloists are Sheila Armstrong, soprano; Norma Procter, contralto; Kenneth Bowenl, tenor; John Cameron, bass.

If you are in the market for a budget priced "Messiah" selection, this should suit your pocket and please your ears. I believe the original recording dates from 1966, so the sound is modern enough to qualify for a "very good" rating. (H.A.T.)

Instrumental, Vocal and Humour

THE NUTCRACKER — Suites 1 and 2 (Tchaikovsky). Paris Conservatoire Orchestra, conducted by Anatole Fistoulari. Stereo, Ace of Clubs (EMI) SCLA 7054.

The well known Suite from "The Nutcracker" ballet was arranged by Tchaikovsky himself and this is the one presented here under the title Suite No 1. The Suite No 2 on side 2 of this disc was selected and arranged by Fistoulari, so its title may be regarded as unofficial.

It consists of the following items: Scene and Coda, taken from the children's party at the beginning of the ballet; Pas de Deux, Scene and Grandfather's Dance, which follows the above in the ballet; Pas de Deux, this being the famous dance of the Sugar Plum Fairy and her Consort, based on the notes of a falling scale — one of the great tunes of the ballet, and unaccountably omitted by Tchaikovsky in his Suite; Waltz of the Snowflakes, played when Clara and the prince are on their way to the Kingdom of Sweets; Spanish Dance — a well-known tune; Final Waltz and Apotheosis.

These items make a welcome addition to the usual Suite, without going to the extreme of the whole ballet, which is a bit too long for just listening. The Paris orchestra plays them all very well, and the sound quality, for a low price recording, is good enough. (H.A.T.)

Reviews in this section are by Neville Williams (W.N.W.), Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.), Gil Wahlquist (G.W.), and Norman Marks (N.J.M.).

VARIETY FARE

MOZART — Violin Concerto No 3 in G Major, K 216. MENDELSSOHN — Violin Concerto in E Minor, Op 64. HMV SERIES 299 stereo SOELP 10071.

Mozart wrote only six concertos for violin as opposed to twenty-seven for piano. Apparently the violin held only a limited attraction to him. But still, while he was interested, he produced some very beautiful music. Sweetness and elegance describes them well. The scoring is for an orchestra consisting of strings plus a pair of horns and oboes. But I rave on. Get your own copy. At the price of $2.99 you won't be sorry. And don't forget the Mendelssohn although I always lean towards good old Amadeus. Sound quality is really good. (L.D.S.)

★ ★ ★

SCHUBERT PIANO WORKS — Sonata in A minor and Moments Musicaux. Alfred Brendel. Stereo, Philips 6500 418.

The Sonata in A minor D784 is one of Schubert's most original and interesting essays in the sonata form, with its dramatic changes of mood and impressive thematic material. And what a splendid performance it is given here by Brendel. Equally enjoyable is his performance of those masterpieces in miniature on the reverse side the six Moments Musicaux. The recording is first class, and the review pressing was faultless. Released on Philips medium priced label, this is a disc which Schubert lovers will not want to miss. (H.A.T.)

★ ★ ★

BARENBOIM IN PARIS. Music of Bizet, played by Orchestre de Paris. Conducted by Daniel Barenboim. Stereo, His Master's Voice. OASD 2915.

Three of Bizet's most popular works are represented here: Carmen Suite — L'Arlesienne Suite No 1 — Children's Games Suite. Some might think a French orchestra best to interpret this essentially French music, but personally I prefer Herbert von Karajan's interpretation of the Carmen and L'Arlesienne suites. One weakness to my mind is the somewhat laboured flute solo in the second Entracte, which sounds distinctly ragged to me. Apart from this and other minor points, one cannot but fail to enjoy this splendid music. The inclusion of the Children's Games Suite will probably be a deciding factor for some people, as the particular combination presented here is rare. Technically, the disc leaves nothing to be desired. (H.A.T.)

★ ★ ★

OPERAS. Waldo de los Rios with the Manuel de Falla Orchestra, Soloists and Chorus. Stereo, Hispavox L34954.

These selections follow very much the style of earlier Waldo de los Rios discs, with fairly straightforward performances of the classical melodies with added rhythm. However, in this case, as operas are involved, we have soloists and choruses, all very competent classical performers, and some of them quite excellent. The outstanding performer is soprano Rukmini Sukmawati, who provides a rendition of Verdi's famous aria "Caro Nome." Rossini's popular "Largo al Factotum" from his "Barber Of Seville" is another very good effort, by an unnamed baritone. Orchestral items are the Prelude to Act 1 from Verdi's "La Traviata," and the Triumphal March from his "Aida."

Also included: Slaves Chorus from "Nabucco" (Verdi) — A Furtive Tear from "Elixir Of Love" (Donizetti) — Humming Chorus from "Madame Butterfly" (Puccini) — Pilgrims' Chorus from "Tannhauser" (Wagner). I find it difficult to make any recommendations in this case — if you think you might be interested, try to hear a few tracks before deciding for yourself. Without being the ultimate in hi-fi, the sound is of good modern standard. (H.A.T.)

★ ★ ★

GOLDEN HOUR OF THE NEW WORLD SYMPHONY. Dvorak. Sir John Barbirolli conducting the Halle Orchestra. Golden Hour stereo GH 534.

I must admit I have never had any great liking for this symphony of Dvorak's, although I find much to like amongst his other works. But now after hearing this rendition by the Halle orchestra conducted by Sir John Barbirolli I am delighted by the essential sweetness of the music. I can highly recommend this version to those looking for a satisfying version. Sound quality is excellent.

Two other short pieces are included: Scherzo Capriccioso, Op 66 and Legends, Op 59; No 4 in C, Molto Maestoso and No 7 in A, Allegretto Grazioso. (L.D.S.)

★ ★ ★

GREAT OPERA CHORUSES Vol 1. Vienna State Opera Chorus Astor Rediffusion stereo GGS 1392.

For those who may wish to "nibble" at the opera chorus, here is an ideal disc: the Vienna State Opera Chorus and chorus master Norbert Balatsch with Vienna National Opera Orchestra conducted by Franz Bauer Theussl. For the most part, the performances on this disc are satisfying but they are marred in parts by deterioration in sound quality, particularly at the inner grooves.

Tracks are as follows: From La Traviata (Verdi) Matador's Chorus, Gypsies' Chorus; from Rigoletto (Verdi) Abduction Chorus Finale, Act 1, Courtiers' Chorus; from Aida (Verdi) Chi Mai, Act 2, Triumphal Scene and Grand March, Act 2; from Tannhauser (Wagner) Entry Of The Guests, Act 2 and The Pilgrims' Chorus, Act 3; from Macbeth (Verdi) Witches' Chorus, Act 2 and Scottish Fugitives' Chorus, Act 3 and the Murderers' Chorus; from The Flying Dutchman (Wagner) Ghost Sailors' Chorus. (L.D.S.)

★ ★ ★

MUSIC FROM THE ONEDINE LINE, THE BRITISH EMPIRE. John Keating conducts the London Symphony Orchestra. Columbia Studio 2 stereo, TWO-372.

While movie and TV theme records are commonplace, John Keating has more than the usual resources to hand in the London Symphony Orchestra. Consistent with this, he has looked behind the various themes to the sources, in some cases, to composers of particular note. Rearranged by Keating to suit the orchestra, and reproduced in wide-range stereo, they have a sound quite different from what usually emerges from the TV set:

Onedin — Sleepy Shores ("Owen, MD") — Panorama ("A Man and a Woman") — The Leaves Are Green ("Elizabeth R") — Manhunt — The British Empire — Casanova — A Family At War — If Love Now Reigned ("Six Wives of Henry VIII") — The Persuaders.

If the thematic background lends familiarity, the LSO under Keating will certainly add a new interest. The quality is well up to standard. (W.N.W.)

★ ★ ★

GILBERT & SULLIVAN HIGHLIGHTS No. 1. Soloists and the Glyndebourne Festival Chorus with the Pro Arte Orchestra, conducted by Sir Malcolm Sargent. Stereo His Master's Voice SOELP 1004.

Gilbert and Sullivan enthusiasts will need no introduction to the tracks on this disc, which are all from the erstwhile very popular series of recordings made under the direction of the late Sir Malcom Sargent in the late 1950s. The complete recordings have been hardy perennials in the World Record Club catalogue almost continuously for the past ten years or so.

Represented in this selection are The Mikado — The Gondoliers — HMS Pinafore. All the best known numbers are included, and if you know your Gilbert and Sullivan you will not need them to be listed. The sound is remarkably good for the age of the

Cassettes

GOLDEN HOUR OF VICTOR SYLVESTER And His Orchestra. Stereo, Astor Musicassette GHC-1048.

To judge by his picture, a very mature Victor Sylvester still manages to sound very bright in this sustained program of dance music. It's all fairly strict tempo material but the wide range of rhythms helps combat any tendency to monotony. There are quicksteps, foxtrots, waltzes, rumbas, cha chas and sambas on side 1, with a further variety on side 2.

Althogether, there are twenty five tracks, most of them well known, for example: Born Free — Lovely Lady — South Of The Border — Love Me Tonight — Whistler And His Dog — Tijuana Taxi, and so on.

Quality wise, it's well up to standard and there's nothing about the cassette to distinguish from the disc. If you like Victor Sylvester, go to it! (W.N.W.)

MUSIC FROM THE MOVIES. The Cyril Stapleton Concert Orchestra. Stereo, Astor Golden Hour Series Musicassette GHC-1042.

There are nineteen well known movie hit tunes on this generous program from the well known Cyril Stapleton Orchestra. Without listing them all, they include: Love Theme From "The Godfather" — Impossible Dream — Randrops — Everybody's Talking — Lara's Theme — As Long As He Needs Me — On A Clear Day — Moon River — Theme From "Romeo And Juliet", and so on.

They're all presented in the appropriate film music style and, played low, would constitute a pleasant gentle background for eating and relaxing. The quality is good, with no obvious distortion or hiss. (W.N.W.)

VARIETY FARE

recordings, being clean but with somewhat restricted dynamic range. (H.A.T.)

★ ★ ★

THE PIRATES OF PENZANCE. Complete recording. The D'Oyly Carte Opera Company, conductor Isidore Godfrey. Recorded under the direction of Bridget D'Oyly Carte. Mono only, Ace of Clubs ACLA. 1276 / 7. Two record set in folding sleeve.

This recording is not old enough, or even good enough, to qualify for the description "Great Recordings of the Past" such as record companies issue from time to time. However, it is ancient enough to have poor quality sound, and I can see no point at all in reissuing it. Gilbert and Sullivan enthusiasts are inclined to be particularly fussy about the recordings they buy, and I feel sure that almost exclusively they would prefer to buy the Decca recording issued a few years ago, which is far superior in every way to this one. My advice is, spend a bit more and have a recording you can enjoy to the full (H.A.T.)

★ ★ ★

ENRICO CARUSO CENTENNIAL. Astor Goldengroove Series GGS 1399.

Ask anyone in the street "who was the most famous tenor in the world" and, nine times out of ten, the answer would be "Caruso". This skillful reworking of some of his most famous recordings shows how his artistry still lives on.

His last recording, made in 1920, is among the eleven tracks which include: The lost chord — Your eyes have told me what I did not know — Love is mine — A dream — Santa Lucia — Agnus Die — L'alba separa dalla luce l'onbra — Hosanna — Tarantella sincera — A vucchella — chi mi frena.

Considering the fact that the recording engineers had only old 78s to work from they have done a superb job. (N.J.M.)

★ ★ ★

ANNA RUSSELL "LIVE" AT THE SYDNEY OPERA HOUSE. Stereo, His Master's Voice OASD 7581.

Anna Russell is way below her brilliant best here, sounding distinctly ill at ease before her Australian audience. Perhaps she sensed some lack of knowledge of the two operas she is sending up in the performance — Mozart's Magic Flute and Verdi's Nabucco. She seems to be resorting to somewhat laboured explanations about the plots and characters. The audience, too, seems far from comfortable, and although they seem determined to show they are enjoying themselves by tittering nervously just about every time Miss Russell opens her mouth, they do not sound very convincing. I gain the distinct impression that the evening was a flop. Still, Anna Russell records are few and far between, and if you are one of her admirers, you will want to judge for yourself. Perhaps an obliging retailer will let you hear a segment or two. (H.A.T.)

★ ★ ★

BLUE TANGO. Various dance orchestras. Karussell stereo 2430 098.

If you fancy a collection of tango by the bands of Alfred Hause, Max Greger, Fritz Schulz-Reichel, Kai Warner, Hans Carste and Heinz Schachtner then here is the ideal disc. Sound quality tends to be little edgy on strings particularly on the inner tracks. But this is more than compensated for by the

Roy Rene lives again . . .

A MAN CALLED MO. Produced for record by Hal Lashwood. Mono, Festival L-35307 / 8. Two record set $7.95.

I've tended to have some reservation about recordings of Mo, partly because I wasn't a Mo fan, and partly because his diction wasn't all that good, as heard on an old-time radio, or on an indifferent recording.

But this set caught me unawares. The recording is crisp and I've never heard the dialogue to better advantage. In fact, I found myself laughing at the old sketches far more than I ever did in the old radio days. To put the record on is to turn back the clock thirty odd years.

If your clock has been going that long, you'll certainly remember these titles: The Scottish Butcher — Mo, The Hero — Mo's New Shower — Mo Joins A Golf Club — Mo Goes To The Dogs — Philip And Aubrey — The Barmaid And The Butcher — Sly Grog — Mo In Opera.

There are several others, made with Sadie Gale, Kitty Bluett, Jack Burgess, Harry Avondale, Harry Griffiths, Edwin Fuin and Hal Lashwood.

With liner notes written by Harry Griffiths and cartoons by Brodie Macl, this is a first rate memento to Roy Rene, one of the greats of the Australian stage. (W.N.W.)

very reasonable price of $2.75.

Track titles are as follows: Jalousie — Rot 1st Dein Maund — Ole Guapa — La Cumparsita — Spanish Eyes — Blue Tango — Noche De Estrellas — Pariser Tango — Schwarze Augen — A Media Luz — Quando M'innamorro — Violetta. (L.D.S.)

★ ★ ★

CLAIR. Werner Muller's Orchestra and Chorus. Decca stereo SKLA 7704.

Werner Muller lays it on sweetly here with a string orchestra and chorus and the occasional brass solo thrown in for good measure. The arrangements are routine for the most part but are pleasantly listenable. Sound quality is good. The best track is "Mouldy Olde Dough" so don't buy because you sampled this one track.

Some of the other tracks are as follows: Nights In White Satin — Amen — You're A Lady — Clair — A Whiter Shade Of Pale — Banana Boat Song — Let's Stay Together. (L.D.S.)

★ ★ ★

THE MAGIC OF GREECE. Stereo, Rediffusion (Astor) GGS-1404.

Whereas some earlier albums of Greek music relied for their acceptance on hit tunes like "Never On Sunday" and "Zorba's Dance," this new one contains items which will normally be unfamiliar, recorded by Bouzouki players in the Margophone Studios in Athens.

The track titles are given in Greek and English but there is no point in listing them here. Three of us listened to the recording: one liked it, another thought the strict tempo bouzouki music boring. My reaction was about midway: pleasant as background music. And I suspect that Michael Ferguson, writer of the jacket notes, felt the same way, with his reference to the atmosphere of the cafe "beneath the shadow of the Acropolis." (W.N.W.)

★ ★ ★

FLAMENCO VIRTUOSO. Philip John Lee. Astor Gold Star stereo GGS 1400.

That anyone could extract such complex rhythms from a guitar seems impossible as you listen to this recording of Philip John Lee. What makes it doubly fascinating is that not only is he an acknowledged flamenco virtuoso in Spain but the man is an Englishman. The idea of a member of that stolid race playing the fiery music of flamenco is difficult to accept.

Recording quality is excellent. I have no hesitation in recommending this disc.

Track titles are as follows: Fandanguillo — Milonga — Solea De Triana — Rondenas — Seguriya — Panaderos — Zambra Mora — Mineras — Media Granadinas — Jaleo. (L.D.S.)

★ ★ ★

BANJO SPECTACULAR Vol. 2. Ron Carson "King of the Banjo." Stereo, EMI series 299, SOELP-10072.

"Everyone likes a banjo" and "most everyone" will have seen Ron Carson on Australian TV variety shows. If you do and if you have, it will help you provide an appropriate mental picture for this live audience recording. If you don't, and if you haven't, you might be content to leave the show to those who obviously appreciated it.

This is not to denigrate in any way Ron Carson's considerable expertise on his chosen instrument. He does some spirited plucking while the backing orchestra turns out jazzed up versions of over twenty tunes including: Roses of Picardy — Lara's Theme — Sweet Georgia Brown — Mammy — Twelfth Street Rag — Stephen Foster Medley, and so on.

If you know Ron Carson's style and like it, this local EMI recording will not disappoint you. If you're not sure, sample a couple of tracks like "Mammy," "Tipperary" and "Melody Of Love" on Side 2. They'll give you a fair idea. (W.N.W.)

★ ★ ★

LIVE AND LET DIE. Sound track of the James Bond film United Artists L 34939 Festival release.

We have violence on TV and films, so we may as well have it on records; this seems to be the theme behind this record of the film sound track. Unless you have seen the movie, the titles will mean little and the music is hardly the sort of program for background or dining use. The technical quality is superb, however. (N.J.M.)

★ ★ ★

HOORAY FOR HOLLYWOOD. RCA Vintage series LPV 579.

Riding high on the nostalgia bandwaggon comes this collection of movie favourites covering the years from 1930 to 1957, with people like Fred Astaire, Ginger Rogers, Marlene Dietrich, Bob Hope, Dorothy Lamour, Betty Hutton and Deanna Durban. Sixteen stars in all are represented with the tracks coming from their best remembered movie roles. The quality varies from passable to deplorable but this can be forgiven if the era interests you. (N.J.M.)

★ ★ ★

THE ROARING TWENTIES, Ferrante and Teicher. United Artists Stereo L34,943. Festival Release.

I thoroughly enjoyed reviewing this record, from the clever cover design evoking the gaiety of the period, to the excellent re-creation of the sounds of the time.

The sound quality is excellent, with twelve old favourites such as — Limehouse Blues — Charmaine — Who's sorry now — It had to be you — Chewin' the rag — Sweet Georgia Brown — Way down yonder in New Orleans — If you knew Susie.

This would be an ideal record to start off that old-time dance. (N.J.M.)

★ ★ ★

A FESTIVAL OF CAROLS. Various choirs. Columbia stereo SOEX 9953.

This review is a little late for Christmas but that is no reason not to look for this disc on the stands. Five renowned choirs put out some superb renditions of these traditional carols. And the price is just $2.99. If you want to sample the disc, have a listen to "Ding, Dong, Merrily On High" or "Lullay, My Liking." Sound quality is variable but mostly good. (L.D.S.)

★ ★ ★

KING OF HEARTS. Englebert Humperdinck. Decca stereo SKLA 5163.

Englebert's latest disc is just as well presented as his previous ones, with polished instrumental backing and good recording standard. The tunes are not as well known as he's sung before but no matter — he sings them well.

Track titles: My Summer Song — I'm Stone In Love With You — Do I Love You — Somebody Waiting — The Most Beautiful Girl — I'm Leaving You — Will You Be Here When I Wake Up In The Morning — Eternally — Only Your Love — That's What It's All About — Songs We Sang Together. (L.D.S.)

★ ★ ★

GOLDEN OLDIES. Popular hit tunes. Probe stereo SPSS 10037.

Here is a collection of pop numbers from "outa da past." They are a re-mastered collage from the original discs which made the hit. Thus, we have Louis Armstrong performing "What A Wonderful World," Mamma Cass with "Dream A Little Dream Of Me" and so on. Some tracks are in stereo.

Quality is variable as is usually the case with this sort of album but it is passable for the material involved and the price of $2.99.

The rest of the tracks are: Girl Watcher — You Gave Me A Mountain — Dedicated To The One I Love — You've Got Personality — Sealed With A Kiss — Eve Of Destruction — California Dreamin' — Cabaret — Sweet Pea. (L.D.S.)

★ ★ ★

OLIVIA NEWTON-JOHN. Interfusion L-45377 / 8. Festival release.

For $7.95 you get a two record album with twenty-six numbers, mainly current hits, sung by Olivia Newton-John with a competent country-rock backing group. Some of the tracks are marred by an attempt to produce a pathetic, little girl lost type of delivery that doesn't quite come off. The record quality leaves little to be desired, however, and if you're a fan of Miss Newton-John I'm sure you will buy the set. Some of the tracks are: Me and Bobby McGee — In A Station — Help Me Make It Through The Night — Mary Skeffington — Living In Harmony — Angel Of The Morning — If We Only Have Love — Changes — If Not For You — If I Gotta Leave — No Regrets. (N.J.M.)

★ ★ ★

HIS GREATEST PERFORMANCES. Richard Harris. Probe stereo SPBA 1075.

Whatever his abilities as an actor, it still seems to me that Richard Harris is not much of a singer. His over-emphasised vibrato tends to inject bathos into his performances. In a word, he overacts. Yet there are many who strongly disagree with me so I suppose this record must sell well. It has all his big hits and is of good recording quality.

Track titles are as follows: MacArthur Park — Didn't We — There Are Too Many Saviours On My Cross — Fill The World With Love — A Tramp Shining — The Yard Went On Forever — Lovers Such As I — One Of The Nicer Things — Requiem — My Boy. (L.D.S.)

★ ★ ★

SING MIT JAMES LAST. James Last Orchestra and Chorus. Polydor stereo 2371 358.

Not much point in listing the track titles here since they are all listed and sung in German of which I understand hardly a word. I can say that the chorus backing James Last do seem to have acquired a little more polish but I still maintain that James is better off without them. Recording quality is fine. (L.D.S.)

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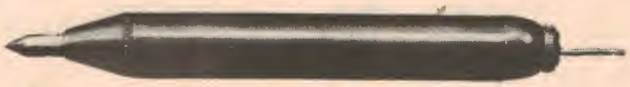

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PRODUCT REVIEWS AND RELEASES

EPI Model 100 Loudspeaker

Loudspeaker systems from Epicure Products Incorporated, Massachusetts, USA, have been recently introduced to Australia by Auriema (Australasia). Here we review the EPI Model 100, which is a two way system with sealed enclosure.

One of the unusual features of the EPI Model 100 loudspeaker, especially for a system originating in the USA, is that it does not have any unusual features — features such as a fancy grille, weird shape, brightly coloured enclosure or esoteric loudspeakers. Its just an unassuming box with external dimensions of 530 x 280 x 229mm. It is finished in a dark timber veneer on four sides and the grille cloth is black.

The grille cloth is not removable but peering through the cloth we could see that the system has a woofer with a large synthetic rubber roll surround and a baffle opening about 20cm. This means that it is larger than a nominal 8 inch diameter loudspeaker. The tweeter has a 25mm diameter.

Cross-over frequency from woofer to tweeter is centred at 1.8kHz. A simple capacitor feed couples the signal to the tweeter, while the response of the woofer rolls off naturally to match the cross-over to the tweeter.

Frequency response appears to be very smooth over the whole range with no noticeable dips or peaks. Bass is well maintained down to about 40Hz and cuts off rapidly below that. High frequencies are well maintained up to the limit of audibility.

A frequency response plot is provided with each Epicure loudspeaker system, probably taken under anechoic conditions. It appears entirely credible and is agreeably flat over the whole range. We know of no other loudspeaker system supplied with an individual frequency response curve.

A tweeter attenuator is provided on the rear of the enclosure, in the recess which also accommodates the input terminals. The attenuator has a large range of control but we found it gave the best tonal balance when set for maximum output from the tweeter.

As a result of the small diameter of the tweeter and its apparently good polar response, treble dispersion of the Model 100 is excellent. At the same time, the loudspeakers give a sharply defined stereo image which is in contrast to some of the so-called omnidirectional systems in vogue today.

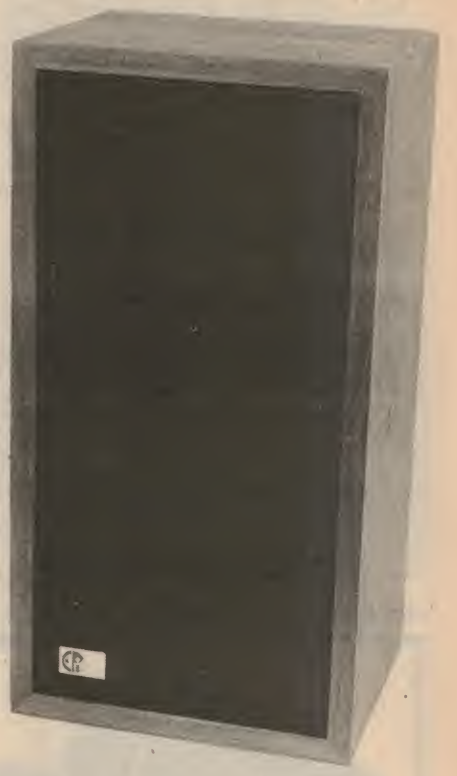
Sensitivity appears to be above average for a speaker of this type (completely sealed enclosure), especially when one considers the flat frequency response. Normally, the designer has to sacrifice efficiency to obtain a good bass response in a sealed enclosure.

Bass boost from the amplifier is not necessary with these loudspeakers. In fact, if they are mounted on the floor, some bass cut can be applied to advantage. However, if the listener is bass hungry, the power handling capability is such it will accept full bass boost from the amplifier even up to loud listening levels.

Overall, the Model 100 system has surprisingly high power handling capability and will comfortably accept the full output of amplifiers up to at least 40 watt per channel rating. This means that they can make some very loud sounds indeed.

Transient response is also very good. About the only negative characteristic we can comment upon is the small degree of colouration from the tweeter at about 3kHz. Still this is less than we often experinece from similar two-way loudspeaker systems.

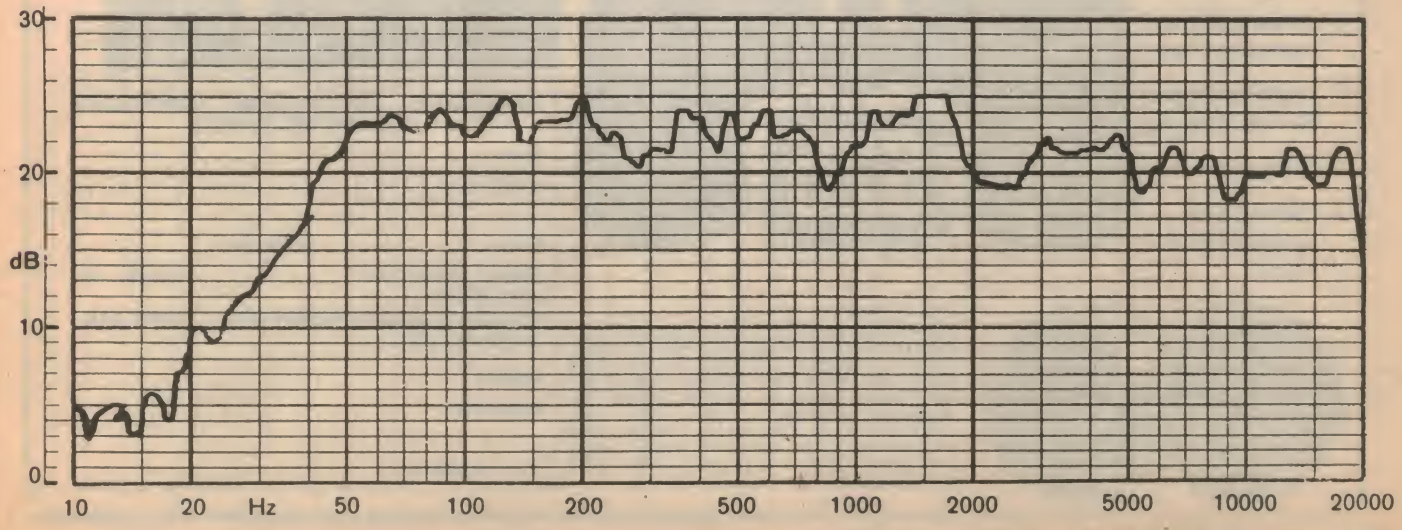
Nominal load impedance of the system is 8 ohm. Measured impedance is quite flat over the whole range and never dips below about 5 or 6 ohms, so it will present no problems as far as the driving amplifier is concerned.



A five-year guarantee applies to the Model 100, which shows the manufacturers have considerable faith in their product. Suggested retail price of the Model 100 is $139 each.

Further information on Epicure loudspeakers can be obtained from the Australian distributors, Auriema (Australasia) Pty Ltd, 15 Orchard Road, Brookvale, NSW 2100. (L.D.S.)

Below: Typical Model 100 response curve.



NEW PRODUCTS

New Oscilloscopes from Advance

Two new solid-state oscilloscopes have recently been added to the test equipment range of Advance Instruments. They are the OS250TV which has a 10MHz bandwidth, and the OS1000A which has a 20MHz bandwidth. Both oscilloscopes have facilities for dual trace operation, and have active TV sync separators.

Both units have the same basic case, which has dimensions of 178 x 285 x 394mm (W x H x D) excluding knobs and handle. Weight of the OS250TV is 7kg while the OS1000A is 9kg.

Common features of both oscilloscopes are as follows: Display area of 10 x 8cm, with the choice of standard or long persistence phosphors. EHT in the 250 model is 3.6kV while in the 1000 model it is 4kV. The display tube in both is a PDA type (post-deflection acceleration) which has a spiral anode down the length of the tube to give a clearer, brighter trace than conventional tubes.

Operating temperature range is 0 to 50C, with a slight bandwidth reduction at the extremes of this range together with a degradation accuracy of approximately 2 pc.

The majority of signal connections are via BNC connectors, while the remainder are via lanana jacks. Operating voltage range is adjustable to suit the range from 103 to 130V and 190 to 260V, at line frequencies from 45Hz to 440Hz.

As with most oscilloscopes of this type, beam switching circuitry is used for the dual trace function as this allows a simple and economical CRT gun structure. Automatic selection of either chopped or alternate switching modes is performed according to the time base range in use. The chopping rate is approximately 250kHz.

On the OS250TV, the vertical amplifiers have a range of sensitivity from 5mV / cm to 20V / cm in a 1-2-5 sequence. Bandwidth is DC to 10MHz within 3dB or 2Hz to 10MHz within 3dB for AC coupling. Input impedance is 1 megohm shunted by 28 pF.

Eighteen timebase ranges are provided, in a 1-2-5 sequence from 1us / cm to 0.5sec / cm. Accuracy is plus or minus 5pc. An X10 switch to increase the horizontal deflection amplifier's sensitivity gives the maximum sweep speed of 100ns / cm. A timebase vernier is provided. One position of the timebase range switch connects the Y1 amplifier to the horizontal plates for calibrated X-Y operation. Thereiis also provision for direct connection to the X amplifier.

Fairly comprehensive triggering facilities are provided with AC coupling. A slide switch gives the choice of AC, TVL and TVF. In the TVL mode, the TV line sync pulses are amplified and used for the trigger input while in the TVF mode a filter is switched into circuit to reject the line pulses and accept the frame pulses for triggering. *(Continued on p99)*

Advance OS1000A 20MHz oscilloscope.

Advance OS250TV 10 MHz oscilloscope.

NEW PRODUCTS

Superex PRO-BVI Stereo Headphones

Superex Electronics Corporation is yet another name to add to the list of quality audio manufacturers now represented in Australia. For those to whom the name is unfamiliar, Superex is an American manufacturer who specialises in high quality stereo headphones. Here we review the Superex PRO-B VI headphones.

The Superex PRO-B VI stereo phones have one unusual styling feature that the prospective customer cannot help but notice. The large plastic housings are transparent, so that you can see the cross-over network components and some of the internal wiring. While it does not add anything to the sound quality it does not detract, either, and one must give the designer full marks for a novel and effective sales gimmick. At the very least, it draws attention to the fact these phones have loudspeaker construction. The high frequency units are described in the Superex literature as coaxially mounted ceramic tweeters. We assume that they are piezoelectric transducers as they appear to be driven by miniature transformers (one of the advantages of the clear housings).

Listening tests with both sinewave signals and music indicate that while these phones may not have the flattest frequency response of those we have heard, they are very good in this respect. The bass is well

The Superex PRO-B VI headphones have clear housings through which the cross-over network components can be seen.

woofers and tweeters.

Other highly visible features are the large, softly padded removable ear surrounds and the fully adjustable headband — which is also softly padded. Inside, the ear pieces are lined with a thin foam so that if your ears are larger than usual they are not crammed up against a fancy but uncomfortable grille.

A generous length, 4.5 metres (15 feet), of coiled connecting cord is provided, which terminates in a moulded plug. This cord is highly flexible so that it causes very little pull on the phones. Nevertheless, a clothes clip is provided to attach part of the cord to the user's pocket or trouser belt so that the slight pull is relieved. Because of the cord length, one is free to dance about in silence (if you wish) instead of being tied close to the amplifier or tape deck.

Weight of the headset, not including the connecting cord, is a reasonable 560 grams (20 oz) which should not prove tiring for long listening periods. In fact, we found the overall comfort of this headset to be excellent, with the headband padding and adustability just right.

Colour scheme is chocolate brown and chrome with a black connecting cord.

The low frequency drivers, or woofers, appear to be reasonably large at about 60mm in diameter and are of conventional maintained and clean without being emphasised as it is in some headphones. The highs are also smooth, and extended without causing record scratch and tape hiss to be over-obtrusive.

Sensitivity and power handling capability appear to be above average so that if very loud listening is one of your criteria, Superex must be considered. Power handling in the bass region was particularly good, so that it can accept plenty of bass boost from the amplifier.

Sound isolation, ie attenuation of unwanted external noises, is very good. Conversely, other people in the room with a headphone listener are not likely to be bothered by extraneous sounds if he is listening at high volume.

If you take all the features of the Superex PRO-B VI such as comfort, frequency response, power handling, sensitivity, isloation and so on, it would be very hard to pick a better set of stereo headphones. Even though the suggested retail price is high, at $68, they must be rated a good buy.

Superex headphones are available from retailers of high-fidelity equipment throughout Australia. Further information can be obtained from the Australian distributors of Superex, Jervis Australia Pty Ltd, 111 Old Pittwater Road, Brookvale, NSW 2100 (L.D.S.)

NEW PRODUCTS

Schlumberger Digital Multimeter and Accessories

Schlumberger Instrumentation have recently released the Model 4445 3½ digit multimeter and four clip-on modules for their 7040 and 4444 digital multimeters.

A new version of the Schlumberger Weston 4440 series of digital multimeters has been released which gives true rms measurement. The model 4445 is a 3½ digit portable instrument which can be powered either from AC mains or from internal rechargeable nickel-cadmium batteries.

Dual slope conversion is used, resulting in a DC voltage measurement accuracy of 0.05 pc. Ranges for both AC and DC extend from 100mV to 1000V with 100 pc over-range.

The true rms converter has a crest factor (maximum ratio of the peak value to the rms value of a waveform) of 4:1 at full scale with a bandwidth of 30Hz to 20kHz.

AC and DC current measurement ranges are 100uA to 1mA with external shunts being

used for higher values. Resistance ranges are 200 ohms t 20 megohms with a maximum sensitivity of 0.1 ohms.

Released at the same time as the 4445 DVM were the four clip-on modules which increase the capability of Schlumberger 7040 and 4444 digital multimeters. These modules clip to the base of the DVM to become an integral part of the instrument.

The four modules are as follows: the 70401 battery pack makes the unit (DVM) capable of operating for a full day without recharging; the active 70402 RF probe unit enables measurements at frequencies up to 400MHz; the 70403 current shunt provides AC and DC current measurement to 10 amps with resolution down to 1mA and the 70404 low level resistance unit which extends the resistance measuring capability down to 100 micro-ohms.

Further information on Schlumberger voltmeters and accessories can be obtained from Schlumberger Instrumentation Australia Pty Ltd, 112 High Street, Kew, Victoria.

Advance Oscilloscopes

When the Trigger Level control is pulled out it provides the so-called "Bright Line Off" mode. When this is used, the timebase will only trigger when the trigger signal reaches the level selected with the Level control. If the timebase does not trigger, no trace is displayed. With the level control pushed in, the timebase will "free-run" in the absence of a trigger signal of the required amplitude. Really, the two modes of operation represent the difference between "syncing" and "tiggering".

Greater bandwidth is provided on the vertical amplifiers of the OS1000A, with the upper —3dB point being in this case at 20MHz for 6cm peak-peak trace deflection. Basic sensitivity is the same as for the OS250TV, except the vertical amplifiers can be cascaded to give a maximum sensitivity of 1m / cm at a reduced bandwidth of DC to 5MHz.

In the OS1000A the vertical signals are fed to a printed delay line in order to give the timebase starting time for each sweep. This ensures that the leading edges of pulses are always visible.

Several display modes are possible with the OS1000A: Y1 or Y2 (ie, either vertical amplifier by itself), Y1 plus Y2, Y1 minus Y2, alternate and chopped dual trace modes and the calibrated X-Y function as provided on the OS250TV. The 250kHz chopped dual trace mode is selected automatically on the timebase ranges below 0.5ms / cm, with alternate mode being used for the higher ranges.

The horizontal deflection timebase of the OS1000A has 20 switched ranges, from 1s / cm to 0.5us / cm. As before the variable timebase knob can be pulled out to provide a further 10 times gain in the horizontal deflection amplifier, to give a maximum sweep speed in this case of 50ns / cm. Trigger facilities are more comprehensive than the OS250TV, with provision for either polarity triggering from the AC power line, DC level triggering and "AC fast" triggering as well as those provided on the other model.

On both oscilloscopes, the controls follow a logical and tidy layout, making them easy to drive. The handle clicks into a number of different positions for use as a tilting bail or for carrying. The power cord wraps around the four mounting feet on the rear of the case, which also enable the unit to be stood on end.

The roomy case completely encloses the rear of the CRT, leaving no bakelite cap on the rear of the case to be susceptible to damage by careless handling. High quality epoxy glass printed boards are used and all components are reasonably accessible within the case.

An interesting feature of the OS1000A is that it has an internal "trace rotation" potentiometer which adjusts the current in an axial winding around the tube — to adjust the trace so that it is parallel to the horizontal graticule lines. This is far more convenient than the usual procedure of loosening clamps and fixtures and gingerly adjusting the CRT by hand.

Overall, the two oscilloscopes appear to be the result of very good design and engineering by Advance, and they deserve to sell well. Prices, not including sales tax, are $569 for the OS1000A and $430 for the OS250TV.

Further information on Advance equipment can be obtained from the Australian distributors, Jacoby, Mitchell Ltd, 215 North Rocks Road, North Rocks, NSW 2151. (L.D.S.)

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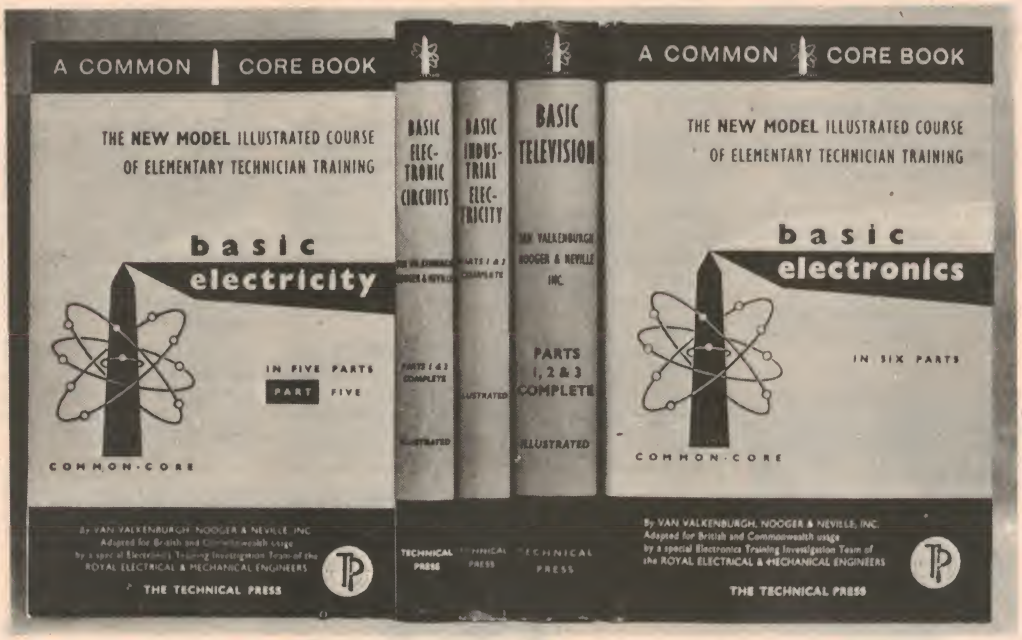

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Books & Literature

Colour TV basics

BEGINNER'S GUIDE TO COLOUR TELEVISION, second edition, by Gordon J. King. Published by Butterworth and Co (Newnes imprint), London, 1973. Hard covers, 193 x 130mm, 189pp, many illustrations. Price in Australia $5.75.

The second edition of this well-known little book, first published in 1964 under the authorship of T. L. Squires. The material has been extensively updated and revised by Gordon King, author of many other books on this and related subjects. And as it deals primarily with the PAL system, this makes it very suitable for the Australian reader seeking an easy-to-read but sound introduction to basic colour TV.

There are eleven chapters, headed: 1 — Historical Outline; 2 — Colours and Signals; 3 — Pictures and Signals; 4 — The Complete Signal; 5 — The PAL Signal; 6 — Colour Transmission; 7 — Displaying the Colour Picture; 8 — Domestic Aerial Systems; 9 — The PAL Receiver; 10 — SECAM Basics; 11 — Colour Receiver Controls.

As with the first edition, the text is written in clear language, and is well served by illustrations. The material appears to be quite up-to-date, with mention of such developments as the Trinitron tube and varicap tuners where one would hope to find them.

There are of course minor differences between the British and Australian colour TV standards, such as the use of UHF channels vs VHF, and the sound-vision separation of 6.5MHz vs 5.499MHz. However by and large these should not detract from the undoubted value of the book for local readers.

The review copy came from the local office of the publisher, but copies are available at all major bookstores. (J.R.)

Test procedures

BASIC ELECTRONIC TEST PROCEDURES, by Irving Gottlieb, First edition 1973. Published by Tab Books, Blue Ridge Summit, PA, USA. Soft covers, 137 x 217mm, 416pp, many diagrams and circuits. Suggested price in Australia $8.70.

As the title implies, the accent here is on test procedures. Test equipment of the standard, everyday type is discussed in conjunction with various sections of circuitry. The interpretation of the results is the key to successful operation.

Beginning with simple DC resistance measuring equipment and a discussion on the capabilities of meters and bridges of various kinds, the author progresses to more sophisticated testing, connected with colour TV receivers. The tests become more involved but the equipment remains a minimum of basic instruments. At all times correct use of equipment and interpretation of results is the watchword.

Written in an easily readable fashion for the technician and advanced hobbyist, the book is a useful addition on the workshop bookshelf. It is recommended for anyone requiring this type of information.

The review copy came from the distributors, Grenville Publishing Co. Copies should be available in all technical bookstores. (F.J.S.)

Amplifier testing

TROUBLE SHOOTING SOLID STATE AMPLIFIERS, by Ben Gaddis. First edition 1973. Published by Tab Books, Blue Ridge Summit, Pa, USA. Soft covers, 136 x 214mm, 256pp, many circuits and diagrams. Recommended price in Australia $6.15.

This is the second book of a trilogy by this author, who appears to be well acquainted with his subject. He writes in an easily understood manner and aims at the student or young technician level. The first books having dealt with power supplies, this one deals with amplifiers.

Each chapter deals with a different type or class of amplifier. Firstly the application is outlined, with reasons for choice and a description of its operation. This is followed by a point by point analysis of signal, or lack of signal, tracing through the circuit.

Each particular type of amplifier is described in some detail. There is a general absence of formulae, the description being made in general terms.

The subjects covered in the chapters are as follows: 1 — the basic amplifier, 2 — audio signal amplifiers, 3 — audio power amplifiers, 4 — paraphase amplifiers, 5 — high frequency amplifiers, 6 — AGC circuits, 7 — differential amplifiers, 8 — operational amplifiers, 9 — field effect transistor amplifiers, 10 — integrated circuits. A four-page index completes the volume.

A well-written, concise accumulation of factual and informative data. A good companion to the first of the series. The review copy came from the local distributors, Grenville Publishing Co. Supplies should be available from all large technical bookstores. (F.J.S.)

Transistor circuits

TRANSISTOR CIRCUIT APPROXIMATIONS, by Albert P. Malvino. Second edition. Published by McGraw-Hill Book Company, New York, 1973. Hard covers, 235 x 160mm, 499pp, many diagrams. Price in Australia $9.90.

A thoroughly down-to-earth book on transistor circuit analysis and design, written both for the person who doesn't intend delving deeply into solid state physics and for the student who wants a good basic grasp of the broad realities before doing so. The emphasis, as the title suggests, is on adopting simple but sound device and circuit approximations to facilitate constructive thinking.

The book deals with diodes, bipolar transistors, FETs, special diodes, the unijunction, thyristors and opto-electronic devices. It includes tutorial problems, with answers at the rear of the book. The text is written in a clear, easily read style, and is well served by illustrations.

In short, an excellent text on basic transistor electronics, and one which would be ideal for either college students or the keen amateur. It would be a very good choice as follow-up reading after my own handbook "Fundamentals of Solid State."

The review copy came from the local office of the publisher. (J.R.)

The third "R"

ELECTRICAL CALCULATIONS, by Arthur Mychael. Published by McGraw-Hill Book Company, Sydney, 1973. Paperbound, 227 x 156mm, 207pp, many diagrams. Price in Australia $3.95.

A book designed both for the student undergoing an electrical trades course at technical college, and for the established tradesman needing a "brush-up" reference. It deals with the basic mathematical concepts used in electrical and electronic work: arithmetic, fractions and decimals, squares and square roots, positive and negative numbers, the use of the slide rule, and units and dimensions. There are also a number of data appendices, giving such things as log and trig tables, basic concepts of graphical geometry and trigonometry,

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and the manipulation of expressions.

The text is concise and presents the material in a clearly followed manner. Each section concludes with tuitional problems, the answers to which are given at the rear of the book.

A useful reference for either organised or private study.

The review copy came direct from the publisher, but copies should be available from all comprehensive bookstores. (J.R.)

Servicing solid state

RCA SOLID STATE SERVICING, prepared by RCA Institutes, Inc. Published by RCA Corporation, Harrison, New Jersey, 1973. Soft covers, 205 x 135mm, 352pp, many diagrams. Price in Australia $4.65 plus postage.

A further release in the RCA library, this one is intended as a compact course on solid state circuit operation and troubleshooting for the service technician. After describing the basic operation of the various common semiconductor devices, it proceeds to discuss the operation of the various types of equipment: AM and FM receivers and stereo tuners, hi-fi and tape recorders, and monochrome and colour TV receivers. Finally there are four chapters dealing with troubleshooting techniques and procedures.

The text is written in practical language, and does not risk confusing the reader with masses of theory. At the same time, it gives sufficient explanation of basic device and circuit operation to ensure that the technician will have a satisfying understanding. The text is generally well supplemented by illustrations, although not surprisingly the circuits used to show each of the types of equipment are all from RCA equipment. This will inevitably reduce the value of the book slightly for Australian readers, but even so it should be found a very worthwhile acquisition. It certainly represents good value for money.

The review copy came from the Technical Book and Magazine Company, of 289-299 Swanston St, Melbourne, who advise that it is available for $4.65 plus 60c postage with Victoria, or 80c postage to all other States. (J.R.)

Thick films

THICK FILMS TECHNOLOGY AND CHIP JOINING, by Lewis F. Miller. Published by Gordon and Breach Inc, New York, 1972. Hard covers, 235 x 160mm, 220pp, with photographs and diagrams. Price in UK 5.00.

A rather specialised book, intended mainly for the practising technologist. It deals at considerable depth with the various techniques involved in the manufacture of thick film components, and in the interconnection and bonding of semiconductor device chips. It will apparently form the first volume in a new Gordon and Breach series headed "Processes and Materials in Electronics."

There are nine chapters in all, titled as follows: 1 — Screening and Paste Transfer; 2 — Thin Film Conductors; 3 — Silver Palladium Electrodes; 4 — Ternary Alloy Electrodes; 5 — Glaze Resistors; 6 — Controlled Collapse Reflow Chip Joining; 7 — Survey of Chip Joining Techniques; 8 — Critique of Chip Joining Techniques; 9 — Powder Interconnections. The book ends with a fairly extensive bibliography and a topic index.

For the practising technologist or the graduate student seeking an up-to-date reference on thick films and chip joining, it should be of considerable interest.

The review copy came direct from the publisher, and no information was given regarding local price and availability. (J.R.)

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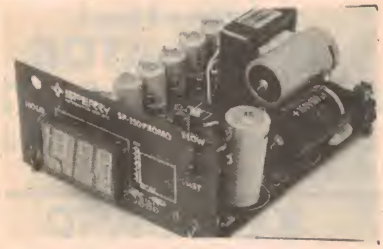

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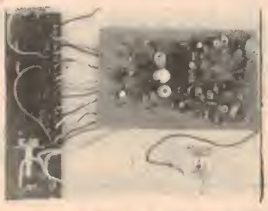
As advertised in July, ETI, this professional quality pre-amp kit includes VP-1, VP-3, a record/play switch which can be fitted to the VORTEX deck "record" button to take advantage of the fool-proof interlocking record mechanism, and a mains power supply, together with input/output sockets, knobs etc — no extras required. Slider pots may be supplied if required. Complete Kit (record and playback) **$34.50** post 50c. Vortex Deck Mechanism — **$28.00** post free.



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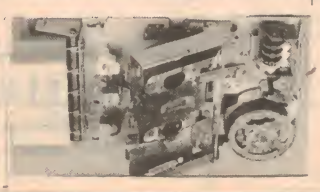

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Amateur band news & notes

by Pierce Healy, VK2APQ

So You Want to be an Amateur?

In response to numerous written requests, here is an outline of the conditions set down by the PMG's Department under which amateur licences are granted, and the qualifications which an applicant must have to satisfy these requirements.

In recent weeks more written inquiries than usual have been received from people desiring to set up an amateur station. In the majority of cases the writers had little idea of the requirements to be met before an amateur licence could be obtained.

Some of the inquiries received were worded along the following lines.

"What would be a reasonable cost to have an amateur station installed in my home?"

"I am taking up amateur radio, what should I spend on a transmitter?"

"I am going to buy a transmitter, how do I let amateurs know I will be wanting to talk to them?"

"I want to buy an amateur station so that I can talk to amateurs, would you let me know where I could get a good one cheap?"

"If I joined the WIA how long would I have to wait for them to send me my licence?"

With so many commercial communication services in use, particularly taxi cabs, it appears that many people imagine that all that is necessary to become an amateur is to pay a licence fee if you can afford to purchase the equipment. Hence that type of inquiry.

Of course, a number of letters also ask about facilities to study for an amateur licence. These are more readily answered.

One difficulty in answering these inquiries is that often it is not possible to be sure if the inquirer is a young schoolboy, a teenager or an adult.

As many claim to be regular readers of "Electronics Australia", it is assumed that they would be interested in some facts about the amateur service.

There are no short cuts to an amateur licence. It is granted only after the applicant has passed a comprehensive examination set by the PMG's Department.

If the applicant passes this examination, the PMG's Department will issue an "Amateur Operator's Certificate of Proficiency" (AOCP) or an "Amateur Operator's Limited Certificate of Proficiency" (AOLCP).

This certificate is not a licence. When it is issued, the prospective amateur may apply for a licence. Assuming the PMG's Department considers he is a suitable person, a licence will be granted.

The only examination exemptions are to those holding an amateur licence issued by a foreign country which has reciprocal licensing agreements with Australia, or to persons having qualifications at a higher standard than that required for amateurs. However, the PMG's Department still retains the right to insist that such a person sit for re-examination.

At present, there are two grades of licence issued by the PMG's Department: a "full" and a "limited" licence. The "full" licence is issued after the applicant obtains the AOCP and the "limited" licence after obtaining the AOLCP. The exam for the AOLCP does not include a telegraphy (Morse) test, but limited licensees are restricted to operation above 52MHz.

A third grade licence, to be known as the Novice Licence, has been approved by the Department. It is expected that details will be promulgated very shortly.

A brochure (RB 125) issued by the Radio Branch, PMG's Department, sets out the conditions under which the AOCP or the AOLCP may be obtained. All amateur applicants should obtain and study this brochure, but the following are pertinent points from it.

A Certificate will not be issued to persons under 14 years of age.

A fee of $6.00 is charged for the examination and issue of either Certificate.

Applications to attend an examination should be made to the Superintendent, Radio Branch, in the State in which it is desired to be examined.

Applicants must supply a copy or extract of their birth certificate, and naturalisation certificate where applicable.

Examinations are held on the third Tuesday in February and August each year in each State capital city and at other selected cities or towns. Candidates in remote areas may arrange for the exam to be conducted at the nearest official post office.

The examination consists of three sections:

Section L (Telegraphy): (a) A Morse test of 2½ minutes duration covering the correct transmission of text in plain language (English) — including figures — at a speed of ten words per minute. (b) A Morse test of 5 minutes duration covering the correct reception by ear of text in plain language (English) — including figures — at a speed of ten words per minute.

The text shall average five characters to a word, each figure counting as two characters.

Section M (Theory): A written examination of 2½ hours, duration, consisting of one paper containing questions based on the theory of radiotelegraphy and radiotelephony as applied to amateur transmitting and receiving systems and the elementary theory and practical application of the principles of electricity and magnetism.

Suggested Textbooks: Radio Amateurs Handbook (ARRL); Radio Handbook (Editors and Engineers Ltd); The Radiocommunication Handbook (The Radio Society of Great Britain).

Section K (Regulations): A written examination of 30 minutes' duration consisting of one paper containing questions based on the Radio Regulations in force under the Telecommunication Convention, and the Wireless Telegraphy Regulations, as relate to the operation of amateur stations.

Suggested Textbook: Handbook for Operators of Radio Stations in the Amateur Service (PMG Australia).

In addition to the exams in February and August, exams for Morse only are also held on the third Tuesday in May and November.

Copies of previous examination papers may be obtained free from any Radio Branch Office.

Successful candidates may apply for a licence. They are required to furnish: (a) a declaration concerning the secrecy of wireless communications; and (b) a recent head-and-shoulders photograph (taken "full face" without any hat and with a plain background), about 2½ inches by 2 inches, autographed on the front.

Further information on various other aspects of amateur radio are contained in a booklet "So You Want to be a Radio Amateur" issued by the Wireless Institute of Australia. A copy may be obtained by writing to the WIA Divisional Secretary in the State in which you reside. The addresses are;— New South Wales — 14 Atchison Street, Crows Nest, 2065. Victoria — 478 Victoria Parade, East Melbourne, 3002. Queensland — Box 638, GPO, Brisbane, 4001. South Australia — Box 1234K GPO, Adelaide, 5001. Western Australia — Box N1002, GPO, Perth, 6001. Tasmania — Box 851, GPO, Hobart, 7001.

The information is also available in the "Australian Radio Amateur Callbook" published by the WIA, cover price $1.20 from major book stalls or plus 30c postage and packing from the WIA addresses above.

QUARTER CENTURY WIRELESS ASSOC.

The end of the year get-together, a Christmas dinner party given by members of the Sydney Chapter Quarter Century Wireless Association to their wives, was held at the Royal Automobile Club, Macquarie Street, Sydney on Monday evening 10th December, 1973. Thirty-one persons were present.

The feature of the evening's proceedings was the presentatio of the "50 year QCWA Award" to Lionel Swain, VK2CS. Lionel is the first Australian amateur to receive this award. The presentation was made by Harry Caldecott, VK2DA, president of the Sydney Chapter, who complimented Lionel on his achievement and contribution to amateur radio.

Presentation at the QWCA Christmas dinner party. Lionel Swain, VK2CS, is holding the Golden Anniversary Award, presented by Harry Caldecott, VK2DA, on his right. Others in the picture are Pierce Healy, VK2APQ, (left) and Brian Anderson, VK2AND (right). Photo by Eric Bierre, VK2BEH.

Available to QCWA members who have been licensed for 50 years or more, the award, a handsome gold embossed certificate, is issued by the QCWA headquarters in New York, USA.

In accepting the award, Lionel recalled some of his past experiences in amateur radio. He also recalled several of the old time operators who, through their amateur activities of more than half a century ago, contributed so much towards radio communication and entertainment services in Australia.

QCWA membership is open to amateurs who have been licensed for 25 years or more. The Sydney Chapter get-togethers are held on the second Wednesday of each month at the North Sydney RSL Memorial Club. An invitation to join is extended to those elibible. Details from: President, Harry Caldecott, VK2DA: Secretary, Pierce Healy, VK2APQ or Treasurer, Brian Anderson, VK2AND, at their call book addresses.

MARCONI CENTENARY CELEBRATION

Guglielmo Marconi was born at Bologna on 25th April 1874. During the month of April 1974 many meetings will take place at the Villa Griffone. The Marconi Foundation has assigned to amateurs the last weekend of March 1974.

A commemorative station II4FGM (Fondazione Guglielmo Marconi) will be particularly active from 29th March, 1974, to the end of April 1974. On the 25th April, the station will be open for 24 hours and at 0815

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown, 2200.

ELECTRIC CAR FAN

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50,000 Ohms per Volt DC.
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Specifications:
DC Volts: 0.25, 2.5, 10, 50, 250, 500, 1000.
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DC Current: 25uA, 5mA, 50mA, 500mA.
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Accuracy: DC ± 3 p.c., AC ±4 p.c. (of full scale).
Batteries: Two 1.5V dry cells. Overload protected.

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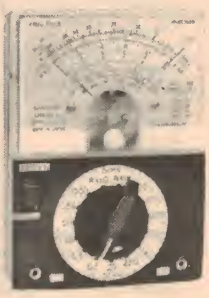

Pocket-size 3¼" x 4½" x 1¼". Instruction sheet and circuit.

SPECIFICATIONS:

DC Volts: 2.5, 10, 50, 250, 1000. 10,000 ohms per volt.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: .1, 25, 250mA.
Resistance: 20K and 2M.
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AMATEUR NOTES

GMT, the hour of Marconi's birth, a short commemorative message will be radiated by II4FGM to all amateurs.

A special commemorative QSL card will confirm all contacts made with II4FGM on 25th April.

An international amateur meeting organised by the Associazione Radiotecnicia Italiana, (ARI) branch section of Bologna will take place on the 25th April 1974. The ARI is the national amateur organisation in Italy

YA CALL AREA

By order of the Minister of Communications of the Republic of Afghanistan on the 18th August 1973, all amateur radio activity was ended. All amateur radio equipment was sequestered by the Ministry.

In an item published in the journal of the International Amateur Radio Union, Region I Division, Afghanistan amateurs expressed their thanks for the co-operation, good fellowship and technical assistance that has been afforded to them.

They request that any QSL cards be retained in the bureau of origin as the post office address for the Afghanistan QSL bureau no longer exists Until the ruling is modified there will be no further amateur activity from that country.

Afghanistan is in Region III of the IARU, along with Australia, New Zealand, Japan, India, China, Korea, Singapore, Malaysia, Thailand, the Philippines, Indonesia to name a few.

Although the reason behind the Afghanistan action is not known, the question can be asked; "What action, through diplomatic channels, has been taken by the Region III Association on behalf of fellow amateurs in Afghanistan?" Through the International Telecommunication Union, the IARU is recognised as the representative of the Amateur Service. As such, the IARU should be able to enlist diplomatic interest in a matter like this, from sympathetic administrations who appreciate the amateur service.

Attention is drawn to the fact that at the Region III Association conference in Tokyo in March 1971, two points were emphasised: Proposals on methods of development and encouragement of amateur activity in Region III; The need to publicise amateur radio activities through the various news media.

Is the apathy towards these points, so evident since 1971, on the part of the Australian representatives of the Region III Association, going to continue? Are things to be allowed to drift along, despite the concern for the future of the amateur service being expressed in other countries?

Independent of any amateur radio organisation, these columns publicise amateur activity as suggested in the second point emphasied at the Tokyo conference.

Regarding the first point; any news on Region III activity worthy of promotion would also be highlighted.

INTERNATIONAL SYMPOSIUM

Organised by the Israel Amateur Radio Club, an International Symposium of Radio Amateurs in the Satellite Era, was held in Tel Aviv at the end of June 1973. Amateurs from the following countries participated:— Argentina, Australia, Brazil, Canada, England, Finland, France, Germany, Iran, Israel, Netherlands, Republic of South Africa, Switzerland, USA, Venezuela.

The opening address was given by Mr S. Peres, Minister of Communications for the State of Israel. The minister emphasised the value of amateur radio in training individuals and increasing understanding between people of different cultural backgrounds.

Mr H. Davidi, Israel Satellite ground station manager, presented a talk on the Intelsat system and details of the local station. Later the chief engineer Abe Nagel, 4X41X, conducted a tour of the station.

George Jacobs, W3ASK presented a talk on the historical background of sunspot activity and the effect on HF communication, and a look at DX predictions for the next three years.

Other speakers included Alex Vilensky, 4X4MH, Ami Shami, 4X4DK, Art and Madeline Greenberg, W2LH and W2EEO.

INTERNATIONAL AMATEUR RADIO CLUB

A meeting of the International Amateur Radio Club will be held at the ITU headquarters in Geneva on 27th and 28th July 1974.

The president of the IARC Dr M. Joachim, OK1WI, will be glad to hear from persons who may be attending.

The meeting will follow the XIIIth Plenary Assembly of the International Radio Consultative Committee (CCIR). The Technical Panel set up for the IARC meeting will have as its main theme:

"CCIR Studies and the Radio Amateur"

CERTIFICATE HUNTERS CLUB

Since the formation of the "Australian-Chapter 66" of the International Certificate Hunters Club (see p 113 "Electronics Australia", August 1973), the organisers have produced two very attractive certificates for the two sections of the Australian Commonwealth Electorates award, sponsored by the chapter.

The awards, known as "ACE" for establishing contact with stations in at least 25 commonwealth electorates, and the "ACE 125" for contacts encompassing 125 electorates, each have a distinctive background featuring a view of Canberra.

Full details may be obtained from the secretary, J. C. Gutcher, VK3APU, 17 Foulds Court, Montrose, Victoria 3765. Enclose 20 cents in stamps to cover postage.

Do not be surprised if your DX contacts ask which commonwealth electorate you are operating from.

INTRUDER WATCH

In October 1973, there were about 350 stations operating in the exclusive 7MHz, 14MHz and 21MHz amateur bands. This figure is from a summary prepared by the Region I coordinator, Colin Thomas, G3PSM, of the IARU monitoring system.

The IARU monitoring system detects and reports stations intruding into exclusive amateur bands. This work is essential to the future well being of the amateur service.

In Australia intruder watch activity is co-ordinated by Alf Chandler, VK3LC. Reports on intruders may be sent to Intruder Watch, WIA, PO Box 150, Toorak, Victoria, 3142.

WIRELESS INSTITUTE ACTIVITIES

NEW SOUTH WALES

The NSW division, WIA has issued the following information regarding their QSL bureau.

Outwards Bureau: This service only handles cards being despatched on behalf of members. All members' cards are handled at two cards for one cent. Cards are forwarded quarterly to overseas bureaus unless the number warrants a more frequent despatch.

General rules:

1. No credits will be held on behalf of members. Remittance should accompany cards, preferably in stamps. Please do not use cheques or money orders.

2. Post QSL cards to PO Box 96, Frenchs Forest, NSW 2086, or leave at the Wireless Institute Centre on meeting nights. Cards and remittance to be placed in a sealed envelope. Place name, address and call sign on back of packet.

3. In addition to QSO details, no more than five words may be written on QSL cards. Definitely no personal messages. This is a postal regulation. Keep cards to standard postcard size — 140mm x 90mm.

4. Write call sign of station worked on the back right hand side of card and QSL manager details underlined, eg 9Q5RD via W9AES, or G2MI via RSGB.

5. Pre-sort cards into countries and "W" Districts, face uppermost to facilitate sorting.

Disregard of rules may result in cards being returned to sender.

Inwards Bureau: This service receives cards from other bureaus, sorts and arranges for them to be despatched to members.

This section is conducted by the Hunter Branch, NSW Division. The address is PO Box 134, Charlestown, NSW, 2290.

Cards will be despatched for collection by members at affiliated clubs, WIC for collection at general meetings, or sent to members' postal address.

Members must indicate how they wish their cards to be handled. For direct mailing members must forward stamped, self addressed 7" x 5" envelopes clearly showing their call sign on the top left hand corner. Cards will be forwarded to them at regular intervals.

The following table will assist in deciding the value of stamps to be attached to envelopes:

7 cents covers approximately 14 cards.
15 cents covers approximately 29 cards.
20 cents covers approximately 70 cards.
30 cents covers approximately 140 cards.

Envelopes will be despatched when full or at intervals nominated by the member.

If the Hunter Branch is not notified how a member wishes his cards to be handled, cards will be held for approximately six months and then destroyed. Cards not collected from the WIC will be treated in the same manner.

In their own interest members should indicate the manner in which their cards are to be handled. Exchanging QSL cards with fellow amateurs is an age old custom. If you do not wish to engage in the custom then extend the courtesy of informing those you contact of the fact, thereby saving them expense and the Hunter Branch the onerous task of destroying cards sent in good faith.

Central Coast Amateur Radio Club

Seventeenth Annual Field Day — Sunday 24th February, 1974. Amateurs, their families, friends and all interested in amateur radio are invited to attend the Club's annual field day at the Gosford Showground, Showground Road, Gosford, on Sunday, 24th February, 1974.

Program: 8.30am to 10.30am: Registration — Men $2.50, Ladies $1.50, Children 15 years and under $0.50. Includes morning tea, lunch and afternoon tea.

8.45am to 9.15am: Mobile scramble in four sections. (a) High frequency; (b) 6 metres; (c) 2 metre net; (d) 2 metre tunable. Any operator may enter any number of sections in the scramble, log extracts to be handed in at the announcing table before 11.00am.

9.45am: All items for disposal must be in before 9.45am.

9.45am to 10.15am: 40 metre fox hunt.
10.00am to 10.30am: Morning tea provided.
10.00 to 10.20am: 2 metre pedestrian fox hunt.
10.30: Disposals store open.
10.45am to 12 noon: 2 metre fox hunt.
10.45am to 11.30am: Children's events.

10.45am to 11.30am: Ladies' throwing contest in two divisions; (a) Rolling pin, (b) Radios.

11.30am to 1.30pm: Quiz sheets available at the announcing table. Must be returned before 1.30pm.
11.45am to 12.30pm: Lunch served — first sitting.
12.45pm to 1.30 pm: Lunch served — second sitting.
1.30pm: Completed quiz sheets to announcing table.
1.30pm to 1.40pm: 2 metre pedestrian fox hunt.
1.30pm to 4pm: Visit to Reptile Park or tour of area.
2.00pm to 2.45pm: 2 metre fox hunt.
3.00pm to 4.15pm: Afternoon tea provided.

3.15pm to 4.00pm: Talk-in fox hunt in two sections; (a) Full participation, (b) Listener only. Frequencies: Channel 1; Channel B; 52 525MHz.

4.00pm to 4.15pm: Lucky dips.
4.15pm to 4.45pm: Presentation of prizes.

Other attractions: Local produce; Jams and cake stall; spinning and weaving; 807's; soft drinks; children's events; amateur television; lucky door prizes; disposals store; trade displays.

The club station, VK2AFY, will operate from the Showground on Channel 1. The 2 metre fox hunts will be conducted on both 2 metres AM and Channel B.

Should the weather be inclement, there is adequate shelter at the Showground.

On the Saturday evening prior to the field day the clubrooms will be open to welcome visitors to the Central Coast. From 7.00pm members will be in attendance to extend a welcome. The club is located in Dandaloo Street, Kariong, near the Woy Woy turn off on the Pacific Highway just south of Gosford.

The election of officers of the CCARC for 1974 will take place at a meeting on 1st March, 1974.

During 1973 good progress has been made with the many and varied club room and equipment installations. The AOCP classes commenced in October and are held weekly. The Saturday afternoon classes will continue during 1974. For club details write to the secretary, Barry Gibbons, VK2ZUX, PO Box 238, Gosford, NSW 2250.

WIA YOUTH RADIO SCHEME

Unfortunately due to a delay in mail delivery the report from the South Australian YRCS supervisor, Mr Allen Dunn, arrived too late for inclusion in the YRCS feature article last month. The report shows the progress made and the expansion possible if club leaders and instructors are forthcoming from among amateurs in that State.

There were 13 clubs registered with the YRCS in South Australia during 1973. Of these, six were school clubs; Prince Alfred College, Mitchell Park High School, Sacred Heart College, Renmark High School, Thorndon High School, Whyalla High School.

Other clubs were: Pt. Augusta Youth Radio Club, Pt. Pirie Youth Radio Club, Elizabeth Youth Radio Club, YMCA Electronics Club, 3rd Adelaide Boys Brigade, St. Marys Boy Scouts Youth Radio Club, Stradbroke Venturer Scouts Youth Radio Club.

Enquiries came from a number of potential clubs, most of which lack suitable leaders. Leaders and instructors were sought by Christies Beach Scouts, Magill Scouts, a Darwin private school, Poultney Grammar School, Belair Primary School, Elizabeth West High School, Elizabeth High School.

A number of young people seeking a club to join, could not be placed.

There is a big demand for leaders with some electrical, radio or electronic background to instruct radio club members. The job usually untails some organising ability as well.

A number of school teachers are responding to this challenge, producing an increase in the number of

school clubs. In some cases it has been found expedient to hold meetings outside school hours, but using school buildings and equipment.

A stronger interest has been evident from Scout groups, with a tendency for the radio club to function separately and to set up a club station which can be used during the Jamboree-on-the-Air. In such cases amateurs are usually sought as club leaders and instructors. Yet, despite South Australia's success in winning the Remembrance Day Contest, leaders and instructors are somewhat rare when it comes to the dedicated task of assisting the YRCS.

The activities of some clubs have included visits to amateur stations, broadcast radio stations, television stations, etc, picnic outings, parents sessions, and the presentation of awards and certificates.

To encourage club members in the certificate exams, a technical book is awarded each year, to the most successful student, by Philip's Electrical Industries.

There is also keen competition between clubs for the Institution of Radio and Electronic Engineers pennant.

The annual general meeting of the YRCS in South Australia is held in June and is attended by leaders and instructors from clubs throughout the State. This is an ideal opportunity for those starting new clubs to benefit from the experience of the well established clubs.

1972 IREE Pennants presented:

At Norwood High School on Wednesday morning 14th November, before a school assembly of some 1700 students, Mr P. Hutchins, VK5PH, of the electrical depot, South Australian Railways, presented the pennant on behalf of the IREE.

Mr Hutchins outlined the aims of the YRCS and spoke briefly of the career opportunities which can follow membership in a youth radio club. He also spoke of his own experiences as a radio amateur for many years which has resulted in him gaining a good deal of knowledge and many friends with whom he can converse around the world. He congratulated members of the school club on their achievement.

The pennant was received on behalf of the school by Gregory Turner, a successful member of the radio club in 1972. The pennant will be displayed in a room along with other school trophies.

The co-operation of the headmaster, Mr Boward and deputy-headmaster Mr Mitchell was very much appreciated and the result was a very successful ceremony.

The pennant for the most successful non-school club in 1972 was presented to the YMCA Electronics Club at their meeting on 7th December 1973.

The results for the 1973 IREE pennants have yet to be assessed and will be announced later this year.

Sydney University Amateur Radio Club.

The Sydney University Amateur Radio Club has had a very successful first six months. The club has been allocated the call sign VK2BSU/T and has temporarily established the station in a room in the School of Physics, until a permanent site is allocated.

The major activity in 1973 was held in conjuction with the University Open Day in September. The club plans to set up a display at the University's Orientation Week early in March.

The Annual General Meeting will be held in the first weeks of the last term for 1974.

Any inquiries should be directed to the Secretary, Sydney University Amateur Radio Club, Box 398, Wentworth Building, Sydney University, NSW, 2006, or by telephoning Jeff Pages, VK2BYY on 649 9829.

St George Amateur Radio Society

A Morse code tape service is being inaugurated by the St George Amateur Radio Society. Several reels of recording tape were received from an anonymous donor and the task of filling them with copy-book segments of Morse code at various speeds is being done by voluntary helpers.

Members or prospective members wishing to avail themselves of this service to either learn or improve their Morse speed should contact the Secretary, M.S. Mckenzie, VK2BMM, 16 George Street, Penshurst, NSW 2222.

Westlakes Radio Club

After many delays, none due to the lack of effort and enthusiasm on the part of the committee and members, the building which is to be the home of the Westlakes Radio Club has now been resited on land in York Street, Teralba.

Work has been carried out renovating the existing structure. Materials that have been stored nearby have been taken to the site by junior members for use in the canteen, classrooms, library, transmitting room, store and workshop areas.

A main office, entrance foyer and toilet block are also being planned. It is anticipated that 1974 will see the club in full operation in its own premises.

Four members were successful in the November YRCS Intermediate certificate examination: Stephen Hallinan and Peter Rutledge, Honours pass, Bruce Steel and Ian Porteous, Credit pass.

During the Christmas recess, the committee spent some time planning the 1974 activities. For full details write to the Secretary, Eric Brockbank, VK2ZOP, PO Box Teralba, NSW 2284.

Maitland Radio Club

One-hundred-and-twenty people, comprising members and their families, attended the Maitland Radio Club's Christmas party held in the club rooms and theatrette on Saturday evening, 8th December, 1973. Guests included Ald Noel Unicomb, Mayor of Maitland, Mrs Unicomb, and from Sydney, Mr and Mrs P. Healy and Mr and Mrs D. Broadley.

Several short films were screened, including several made by club members, which received well deserved praise from the audience. Alderman Unicomb praised the work being done for the youth of the area and announced that a gift would be made by the Maitland Council to the MRC.

Certificates were presented to successful members in recent YRCS examinations, by Mr Pierce Healy. Those successful were: Elementary Certificates; Warren Smith, Ian Trelfo, T. Robson, S. Higginbottom, S. Hodgson, Michael Ringland, G. Pitts, Brian Dever, Junior Certificates: Vince Shilling, Ian Moore, David Johnson. Intermediate Certificates; Roy Watman, Robert Ford, Robert Cummings, Terry Bugia, John Pitts, Mark Piper, Bill Fox. Senior Certificates; D. Sciffer, I. Lawrence, W. Hooke.

When presenting the certificates Mr Healy praised the work of the instructors, the committee for promoting such an activity, and the progress the club had made since his previous visit two years back.

The City of Maitland Award gained by Garry Watson was presented by Mr D. Broadley, who also praised the work of the club.

Activities for 1974 commenced on 1st February. For all information write to the Secretary, Box 59, PO East Maitland, NSW 2323.

VICTORIA

It has been announced that a new State supervisor has been appointed for the Victorian division, WIA, YRCS.

The new appointee is Reverend Bro. Frank H. Whittom, VK3BAN, St Johns College, 204 Churchill Avenue, Braybrook, Vic., 3019. He may be contacted Monday to Friday from 9.00 am till noon or 2.00 pm till 5.00 pm on telephone 311 0619.

Tutorial notes may be obtained from Keith Nicholls, VK3ANI, treasurer, telephone 663 2201 (B), or the State supervisor.

VHF LISTENING

How many short-wave listeners monitor the VHF net channels, in particular 52.525MHz, is a question posed by David Storos of Enfield, NSW. David uses a converted receiver section of MR10B. If there are any other SWL's interested in net channel monitoring and would like to swap notes write to David Storos, 110 Dean Street, Enfield, NSW 2136.

2 METRE BREAKTHROUGH

A 2 metre opening occurred on Saturday morning, December 22, 1973. Ian, VK4EN, was working Carl, VK2ZGX, in Warrawee via a 6 metre breakthrough, when he reported hearing Sydney stations on channel B (146MHz). Errol, VK2BET, then called VK4EN on 146MHz, but was unable to hear any reply. However, VK4EN reported via VK2ZGX that he had received VK2BET's signals, 5 and 9. It is not clear exactly why a two-way contact was not possible, but VK4EN was running low power on 146, plus the fact that there was considerable local traffic on the channel at the Sydney end.

THE INTERNATIONAL SCENE

The Region I Division executive (United Kingdom, Europe and Africa) of the International Amateur Radio Union, through the "Region I News," keep member societies up-to-date on matters that affect the Amateur Service. They also continually urge all the members to establish and maintain good working relations with their respective administrative authorities Guidance on relevant matters is provided.

During the 1973 meeting of the executive committee in Warsaw, steps considered necessary to safeguard amateur frequency allocations were considered.

Stereo headphones from p25

As we remarked earlier, sound through headphones is a quite different sensation from normal stereo loudspeaker listening. Instead of the sound source being to the front and blended by room reflections, it tends to be all around the listener, but especially at the sides. Left, right and centre sound is more obvious as such.

It is possible to blend the left and right signals electrically in the phone circuit to modify the separation and to provide each ear with a sample of what the opposite one is hearing. However, after a flurry of articles interest in the subject appears to have diminished and headphone sound is accepted for what it is.

Two other points could well be mentioned briefly.

One is that, to listeners with acute hearing, tape hiss and disc "prickle" may be more evident with phones, due to the direct injection of high frequencies into the ear. It may be necessary to adjust the treble control for acceptable listening.

Again, because no one else is involved, there is a temptation to listen at very high volume, leading to hearing damage. Set the volume to a comfortable, not excessive level.

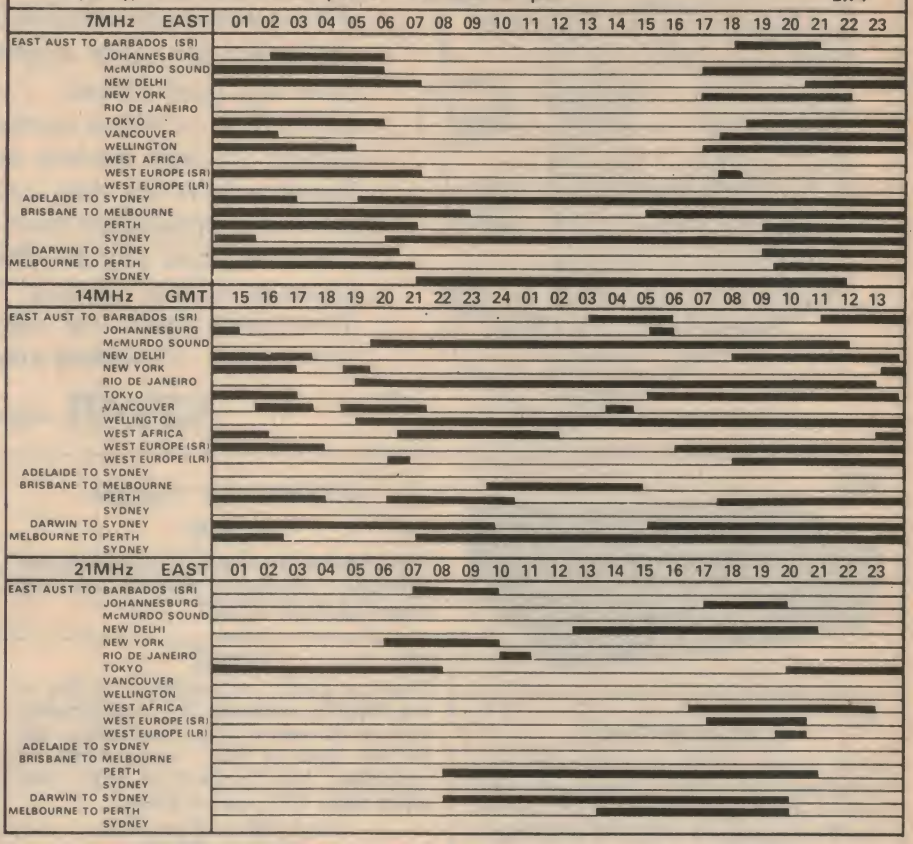
With the arrival on the scene of 4-channel sound, the idea of 4-channel headphones naturally emerged. Though expensive, 4-channel headphones are currently available, each shell containing two distinct sound sources, one behind and the other in front of the ear.

But does the listener actually hear a properly dimensioned 4-channel image? Some say they do. Others maintain that a fully dimensioned image is impossible; front and rear perception depends, they claim, on very slight inclinations of the head relative to the sources of sound, and this is impossible when the sources are fixed relative to the head.

So the argument continues but it will probably be settled by the time that most of us have to face the decision to buy headphones of the 4-channel or quadraphonic variety.

IONOSPHERIC PREDICTIONS FOR FEBRUARY

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Commonwealth Bureau of Meteorology. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 2.74



Participation in the work of the International Radio Consultative Committee of the ITU is stated as one way in which this aim may be achieved. Scientific papers originated by national societies and sent to the CCIR reflect credit on the amateur service and give support to its scientific background.

Although it is not anticipated that matters vital to the amateur service will be raised at the 1974, ITU Maritime Mobile Conference, the committee decided that at least two members of the executive committee should attend at least part of the conference as members of the IARU observer team. The expenditure is considered a worthwhile insurance. The IRAU is an organisation invited by the ITU to its conferences and entitled to receive conference services without payment.

Projects sponsored by the Region I Division include the IARU monitoring system, co-ordinated by G3PSM, the international beacon project, the chairman being G3DME, also a group has been established to provide international liaison on interference matters.

A VHF working group deals with a variety of matters affecting operation in this portion of the RF spectrum. Repeater standards and channelling, beacon station frequencies and band plans are some of the items dealt with.

BAHRAIN

It has been announced that His Excellency the Heir Apparent of the State of Bahrain, Sheik Hamad bin Essa Al Khalifa, MP4BSH, has accepted the presidency of the Amateur Radio Association Bahrain.

Amateur radio licensing was recently introduced in the State of Bahrain, and this task is being undjgtaken by the Permanent Frequency Committee for the Gulf Area and Sultanate of Oman. MP4 licences are issued in the normal manner, to qualified persons who are of residential status in Bahrain. It is not anticipated that there will be any change in the MP4B calls in the near future.

The QSL bureau manager is Ian Cable, MP4BBW, PO Box 425, Awali, Bahrain.

BALLOON REPEATERS

French experiments with UHF VHF repeaters, "Mirabel 1" and "Aniou 3" carried by balloons were very successful. The uplink to the balloon repeaters was on 432MHz with the downlink on 144MHz. There was also telemetry and a beacon on 144MHz. The best DX through "Mirable I" was between Austria and the United Kingdom, a distance of 1100km.

G3JVL heard many stations through "Mirabel 1" these included 8 French stations, 20 German stations, 1 United Kingdom, 1 from the Netherlands, 2 from Belgium and OE3XUA from Austria.

The flight of "Ayou 3" was no less successful; G3JVL contacted F6BSJ, F8SQ, F9FT and narrowly missed a QSO with ON5EB.

Further experiments were scheduled to take place late in 1973.

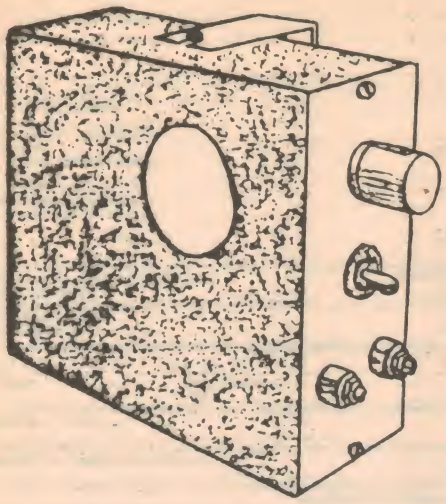
CYPRUS

Amateur licensing has been restored in the Republic of Cyprus. An increasing number of 5B4 stations have been licensed and may be heard on the amateur bands.

USSR

The USSR Antarctic bases have now been allocated call signs with "4K1" prefixes and are as follows: 4KIA — Molodezhnaya, 4K1B — Mirny, 4K1C — Vostock, 4K1D — Novolezareskaya, 4K1F — Bellinghauser 4K1G — Lenningradskava and 4K1H — Russkaya.

(A)



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(B)

HOMODYNE TUNER KITSET

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(C) BARGAIN PACK

$100 worth of brand new electronic components of all sorts, shapes and sizes. This is our biggest selling pack in NZ. You'll be overjoyed with the selection — for only **$23.00.**

(D) BC409

This is a plastic encapsulated version of the BC109, preferred by manufacturers due to its lower cost. Supersedes the BC109. This is NOT a substitute or equivalent, but the identical same transistor chip. Well known brand.

4 for **$1.00** or 10 for **$2.00**
or 100 for **$18.00.**

(E) ASSORTED ELECTROLYTICS

Pack of 20 assorted electro's. Ranging from 2500uf at 40v right down to small values. Retail value $14.00.
Our price **$5.90** per pack.

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100P.I.V. at 1.5 amps. Well known brand.
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(G) POWER DIODE

200 volts at 2 amps. Well known brand.
5 for **$2.00** or 10 for **$3.50**
or 100 for **$30.00.**

(H) VHF KITSET

One transistor, super regenerative, receives Police, taxis, aircraft, etc. Pictorial instructions. Works through an ordinary transistor radio without connecting wires. Heap big magic, eh! ONLY **$4.90**

(I) L.E.D.

Light emitting diode — used as indicators in transistor work. Hewlett Packard part no. 5082 / 4850.
Supplied with panel mounting hardware — draws only 20 ma. Operates as low as 1.6 volts. Data supplied.
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(J) 40841 FET

A popular diode protected dual gate FET — can be used in place of almost any other FET. Data supplied.
$1.00 each or **10 for $8.00**

(K)

20 CIRCUITS AND 12 SEMICONDUCTORS

20 of our most popular circuits and 12 semiconductors, including BC409, AC187 / 88, AC125, OA95 etc. Never before released by us. **ONLY $4.90.**

(L) ONE TRANSISTOR RADIO KITSET

Can be assembled by any child from 8-108. Only a screwdriver required (and a band-aid). No soldering necessary. Coil already wound and mounted (in a funny sort of way). Easy to follow pictorial instructions (my 3 yr old daughter drew them). All parts coded for identification (morse coded). The biggest selling radio kit in NZ (well, Wellington anyway). Complete with super high impedance hi fidelity personal earphone (ie we bought 'em cheap).

Attractively mounted in a see through poly bag (we couldn't afford a carton).

IF YOU'RE WILLING TO TAKE THE RISK — IT'S YOURS FOR **$4.60.**

Over the years we've built 3000 — we've only got 2900 left — be in quick before the borers set in.

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MONEY BACK IF NOT COMPLETELY SATISFIED

INFORMATION CENTRE

GUITAR AMPLIFIER: In reference to your Playmaster 128 stereo amplifier, (January 1970, 1 / SA / 32) would one channel with a suitable preamplifier be suitable for a guitar amplifier intended tor a bass guitar? Could you also please tell me the input impedance of the amplifier and the harmonic distortion at the full 64 watts output? Is the output measured in continuous RMS power?

I would appreciate any help you could give me as I would not want to spend the money only to find it could not be done. (L.T., Springvale, Vic.)

Are you aware that we published an all solid-state guitar amplifier with a continuous power power rating of 50 watts into 8 ohms, in July and August 1969 (File No 1 / GA / 17 and 1 / GA / 18)?

In answer to your question, your idea for a bass guitar amplifier would probably be satisfactory. The input impedance of the power amplifier is approximately 65k and the harmonic distortion at 64 watts is of the order of 1 pc. The power rating is continuous.

LOUDSPEAKER EFFICIENCY: I am planning to purchase a 3 or 5 watt amplifier in kit form together with 8-inch wide range speakers. However, a friend has advised me to purchase a more powerful amplifier, his reasoning being that today's speakers are so inefficient that a 3 watt output would not produce sufficient volume. Was my friend exaggerating about the inefficiency of modern speakers, or will 3 watts be sufficient?

A great deal depends on the type of loudspeakers you intend to buy and the manner in which they are mounted, or intended to be mounted. It is true that many modern loudspeaker systems, particularly the sealed enclosure "bookshelf" type, are relatively inefficient, and 3W may not be enough to drive them in other than the most "compact" domestic situation. On the other hand other types of enclosure such as a bass reflex or folded horn could in many cases be driven quite adequately with 3W.

BC109s: I would like to know whether substitution of BC109Cs for the BC109s in the magnetic preamp using a UA741 IC would improve performance (noise & distortion) to any extent. I have always been under the impression that BC109Cs have a lower noise level than BC109s. (E. J., South Melbourne, Vic).

You have been under the wrong impression, E. J. The A, B or C after the initial type number refers to gain — BC109s have a gain of 200 to 800, while BC109A are 200-400, BC109B 400-600, BC109C 600-800. Substitution would not cause any significant difference in noise level or distortion.

CALCULATOR: Have you ever published a circuit of an electronic calculator — if so, when? (A. Mck., Napier, NZ).

No, we haven't, A. McK. One factor behind this is the fact that electronic calculators are now available in retail stores under $30 — we have seen some as low as $27.50. A kit of parts for a calculator may cost anything from twice to four times this.

TAKE 20 COMPONENTS: I was wondering if you were planning any more of the "Take 20 . . ." series by Julian Anderson. Also, I read somewhere that a new solid state TV picture tube was being developed. Is this true? Have you, or will you, describe an audio power meter to measure output power up to 1.5W using a multimeter and simple circuit? (W. J., Warragamba, NSW).

"Take 20" was reproduced by arrangement with one of our overseas associate magazines and, as such, presented the problem that components for some of the projects were not readily available in Australia. Our present series, "Elementary Electronics" is aimed at presenting simple projects suitable for local market conditions.

Ever since the advent of solid state techniques a number of research workers have been working towards a solid state TV display panel (one can hardly call them "tubes".) A few experimental models have been produced, and offer exciting possibilities. On the other hand, a lot of work will have to be done before they can compare with the modern picture tube.

Regarding the audio power meter we refer you to "Measuring Audio Power Output" of April 1969 (File No 7 / MS / 4) and "A Dummy Load for Amplifiers" from the same issue (File No 7 / MS / 3).

CRYSTAL SET: Re P. J.'s enquiry (December) on cat's whiskers. The July 1973 issue of the English magazine "Everyday Electronics" showed how to build a cat's whisker type crystal set, and offered, through Home Radio (Components) Ltd, 240 London Rd, Mitcham, Surrey, England, a complete kit including the cat's whisker and pre-wound coil for 2.40. (J. C., Christies Downs, SA).

Thank you for the information, J. C.

BACK ISSUE: I would like to obtain a back issue of the magazine, March 1972. Is this still available? Also, regarding the Audio Mate project in the above issue, what would be the DC supply voltage (after the rectifier)? (J. E., Robe, SA).

There are plenty of March 1972 issues availabe, J. E. The price is 60c, plus 30c pack & post. The DC supply voltage for the Audio Mate is approximately 18.

TRANSISTOR TYPE: Your correspondent H. B., Dunolly, Vic, requires information on 2SB494 transistors. "Semi-con" index gives the following information: Germanium PNP, Vcbo 25, Vceo 20, Ic Max or Ie 900mA, Pt 220mW, Tj 100 (c) (all maximum ratings); Icbo 20uA, at 25V, Hfe 35-72, Ic 100mA, Vcb .4, Ft 1.2MHz (all quantified ratings). They are made by Mitsubishi, Japan. (J. M., Gladstone, Qld).

AND MORE: With reference to H. B., of Dunolly, Vic, the "Elcoma" transistor interchangeability guide lists the AC188 as a close equivalent to the 2SB494 (subject to test). (W. J., Warragamba, NSW); J. C., Christies Downs, SA; J. C., Fairfield, Qld).

Well, there you have it, H. B. All the above readers sprang to your aid with an equivalent. Perhaps you will be able to treat transistors with a little less contempt, having solved this problem. Thanks to all the readers who sent in this information.

HOW TO USE OUR INFORMATION SERVICES

As a service to readers "Electronics Australia" is able to offer: (1) Project reprints, metal work dyelines, photographs, printed wiring patterns and other filed material to do with constructional projects and (2). A strictly limited degree of assistance by mail or through the columns of the magazine. Details are set out below:

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REPLIES BY POST: These are provided to assist readers encountering problems in the construction of our projects published within the last two years. Note, particularly, that we cannot provide lengthy answers, or undertake special research or modifications to basic designs. Charge: 80c. Inclusion of an additional fee does not entitle correspondents to special consideration.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee and may be answered in the magazine at the discretion of the Editor. Technical queries will not be answered by interview or telephone.

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POSTAGE & PACKING: All charges shown include postage and packing, unless otherwise specified.

ADDRESS: All requests for data and information should be directed to the Assistant Editor, "Electronics Australia", Box 157, Beaconsfield 2014.

Letters from p29

Comments on CDI

Some 14 months ago I built the CDI in EA, August 1970. I decided to leave it in my car (Mazda 1300, 4 cylinder, 1970 model) for 12 months or so before writing and letting you know the results.

Performance was definitely improved, mainly being smoother running, more power up hills and a slight increase in mileage per gallon. One notable improvement was that in the winter months with the CDI not fitted choke was heavily used at traffic lights due to stalling, while with the CDI fitted this problem was completely eliminated.

Two problems were encountered with the CDI fitted: The first being difficulty in starting during winter months though new points and plugs (set to proper gap) were fitted. The second problem was resistor R3, which on two or three occasions during the 14 months overheated and broke down. I had to make R3 in my unit 220 ohms, otherwise it failed to oscillate.

But my main reason for writing this letter is the rather novel "Hot Canary". A friend at work was discussing with me that his pet canary had never whistled in the 12 months or so that he has had it. I suggested he buy a whistling canary to teach his canary the art, for once his canary did whistle it would perhaps "jolt his memory" and get him going. Canaries are great showoffs and in pairs or more have marvellous competitions trying to out-whistle each other.

By now you've probably put one and one together. Yes, this was a great excuse for me to build your "Hot Canary" which I did. I altered it slightly to produce two different canary whistles by a push of a switch, and gave it to my friend. About one week later I think I was just as exulted and surprised as he was when he told me that his pet canary was now whistling!

Val Starr (Canberra, ACT)

P.S. The "Hot Canary" is also excellent for connecting to the input of the "Musicolour", and gives quite a good display.

COMMENT: These days we find ourselves a little ambivalent as far as CDI systems are concerned. (See "Electronic Ignition reconsidered" EA June, 1973). They can give worthwhile improvements in engine performance and fuel economy yet they can also be a dangerous source of unreliability — a sudden breakdown in heavy traffic could have disastrous consequences.

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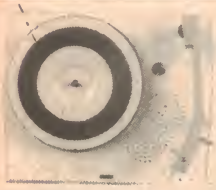

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SPEAKER CABINET

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MSP 6½" SPEAKERS
8 / OHM $4
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6½"

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Push button switch **50 cents.**

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Alligator clips and leads 10 pairs **$1.**

Transistor and driver speaker transformers miniature **$1 a pair.**

Pots 30 mixed values including ganged and concentric **$5.**

Ferrite rods 9 + ½ **50c**

Sato coloured bracket lamps **25 cents**

BSR CERAMIC CARTRIDGE STEREO **$4.**

Morganite and IRC resistors. At least 33 values. Suit transistors, radios, TV etc., **$2.00** per 100. Pack and post. **25c.**
100 mixed condensers, micas, ceramics, tubular. Fresh stock. **$2.00.** Pack and post **25c**

50-ohm POTS ideal for Ext. Speakers. **50c** each.

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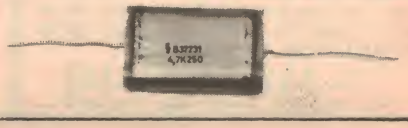

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6 volts, 4-speed, and pick-up **$7.75.**

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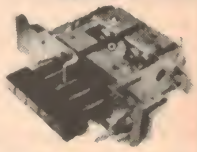
Car Radio Push Button Tuner **$4.50**



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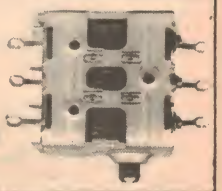

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GOOD QUALITY short wave receiver; Lux amplifier, model 38D. Details to P. Costa, 104 Savoy Drive, Florida Gardens, Qld 4217.

REPAIRS

To all quality Hi-Fi equipment, tape recorders and communications receivers.

All work guaranteed.

BILL TURNBULL,
11 Ellalong Road,
Cremorne, NSW. Ph 90 4825

Amplifier from p51

As explained in an earlier issue, rear channel signals fed into the Playmaster 140 through the "Ext-4" input do not pass through the tone control stage, being reproduced "flat" unless deliberately modified by the Hi and Lo filters. As a result, the signals are not subject to the 180-degree phase change that the tone control introduces and this could lead to difficulties. We have therefore provided a phase change module for the rear channels; strictly speaking, it will be necessary only when you get around to using the Ext-4 input.

Fortunately, the phase change module can be a relatively simple device, devoid of adjustments. As long as the gain approximates unity, any slight difference between the front and back channels will be taken up by the volume control settings, without the user even being aware of it!

As indicated by the schematic circuit, the respective rear signals are fed to two small-signal NPN transistors with equal collector and emitter loads. Since a phase change is required, output is taken from the collectors and made available to the Selector switch.

With the split load configuration, the gain through each stage will be slightly less than unity but balance between stages will depend almost entirely on the 5.6k resistors.

If you want to be fussy, the gain of either stage can be nudged upwards by using a slightly higher value of collector load and / or shunting downwards the emitter load. Increasing the emitter load and / or decreasing the collector load will reduce the gain.

Whether all this effort would be worthwhile is quite another matter!

We built up the phase change module on a scrap of Veroboard 9 tracks wide, measuring 37mm wide by 67mm long. The circuitry was concentrated on 7 tracks, leaving the outer two tracks for mounting. We bent up an angle bracket from a scrap of light aluminium and mounted the unit in the space alongside the loudspeaker sockets.

While shielded lead was used to convey signals to and from the module, the level and impedance of the signal circuitry is such that no other shielding proved to be necessary. A positive lead is necessary for the plus 21V supply but the negative return can be via the shield braid to chassis.

(To be continued)

LANTHUR ELECTRONICS

69 Buchanan Avenue, North Balwyn, Vic. 3104. P.O. Box 162. 'Phone 85 4061.

HAND TOOL SPEED CONTROLLERS

Ready to use & S.E.C. approved. Will vary speed from stop to full without loss of torque. Suitable for all ac / dc or brush type motors.
500 watt (2 amp.) size. *$14.90*
2500 watt (10 amp.) size. *$22.90*
Plus cert. post. Vic. 0.75. Other 1.15

BATTERY CHARGER BASIC KITS

Consist of transformer, bridge rectifier, ballast resistor, pair clips & circuit. Two amp. madel charges 12 volt batteries only. *$7.75*
Four amp. model charges both 6 & 12 volt batteries. *$14.95*
Plus pack & post. Vic. 0.65. Other 0.95

MOTOR SPEED CONTROLLER BASIC KIT

Consists of potentiometer, knob, triac, two diodes, w.w. resistor, 3 pin base, flex, plug & circuit. Controls speed of hand tools or other ac / dc brush type motors from full to stop. Will handle up to 500 watts. *$6.95* Includes pack & post.

LAMP DIMMER BASIC KIT

Consists of triac, diac, pot. w / switch, knob, ferrite rod inductor, 2 caps., 4 resistors & circuit. Will control incandescent lamps from full to out at up to 1400 watts. *$5.95*. Price includes postage.

PLASTIC CABINETS

Suitable for above Speed controller & Lamp dimmer kits. $1.35 Price includes postage.

BATTERY SAVER BASIC KITS

Consist of tapped transformer, bridge rectifier, filter capacitor & circuit. DC voltages from 6 to 15 available. Will replace batteries in radios, toys, rec. players, tape rec., etc.
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BROADCAST BAND TUNER

Complete & ready to build into hi-fi amp. systems, tape rec., etc. Chassis size 6" x 4", with 8" aerial rod & straight line dial 6¾"x1¾". Output approx. ½ volt. Band width 8 khz. DC input 9 volts at 5 ma. *$23.95*
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STRAIGHT LINE DIAL

As used in above tuner. Glass, back plate, drum & hardware. *$5.95.* Including postage.

SILICON DIODES

25 amp. stud mount type. Suitable for automotive or battery charger use. Both fwd. & rev. types avail. 50 P.I.V. rating *$1.25*
Heat sink adaptors to suit. 0.35
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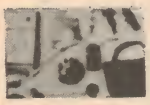
AC125	65c	TT797	1.10
AC126	55c	TT800	90c
AC127	65c	TT801	90c
AC127 / 128	1.25	2N706A	45c
AC128	60c	2N2646	1.30
AC187	80c	2N2926G	55c
AC187 / 188	1.55	2N3053	80c
AC188	75c	2N3054	1.10
AD149	1.30	2N3055	1.30
AD161	1.20	Mat. Pr	2.80
AD161 / 162	2.40	2N3638	40c
AD162	1.20	2N3638A	45c
BC107 / 108 / 109	30c	2N5459	1.20
BC177 / 178 / 179	55c	2N5485	1.30
BD139	1.50	**DIODES**	
BD139 / 140	3.00	BA102	80c
BD140	1.50	OA5	40c
BF115	65c	OA90	15c
BF167	60c	OA91	15c
BF173	75c	OA95	25c
BF177	1.20	OA202	25c
BFY50 / 51 / 52	80c	IN914	15c
BRY39	1.20	1N4004	20c
D13T1	90c	1N4007	40c
OC26	1.50	BYZ13	
OC28	1.50	(6amp. 200v)	75c
OC29	1.75	**SILICON BRIDGES**	
OC35	1.50	1 amp. 100v	80c
OC36	1.75	2 amp. 200v	1.50
OC44	50c	6 amp. 200v	3.00
OC45	50c	**ZENERS**	
OC71	50c	BZY88 type	45c
OC72	50c	1.5 watt	80c
OC74	50c	**SCRs**	
OC81	50c	15 amp. 100v	2.00
OC171	75c	15 amp 400v	3.00
OCP71	1 45		
TAA300	3.00		

"Post 15c (Sorry no COD)"

RETURN MAIL SERVICE

SEMI-CONDUCTOR SPECIALISTS

NEW MODEL



7 TRANSISTOR RADIO KIT

Silicon transistors, complete with instruction book, carrying case and earphones.

Special price $9.75
Wired $12.75
Post and pack, 75c

VHF CONVERTER TUNER

110-136 MHz couples to broadcast receiver, $14.95 P.P. 55c

TRANSISTOR RADIO KIT

2 silicon transistors easy to build — all parts supplied including PC board and full instructions

$5.25 + 216 type battery P.P. 55c

Playmaster Kits

Available 127 / 128, 131, 132, 134, 136

1 transistor radio H.C. type Merc. batteries

Combined ball point pen & transistor radio

Useful at sports meetings, school etc.

$5.25 p.p. 50c

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ALPHA 6 BAND BC MARINE S.W. AIRCRAFT VHF. FM. 15 TR PORTABLE

Battery or 240V AC, tuning meter, 5" spk.

540-1600KHz 1.8-4MHz 4-12MHz 88-108 FM	$109.50
108-135 MHz	R/P.
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10—EM406	$2.50
each	32c
10—800v 1A 408	$3.20
each	38c
10—1000V 1A	$4.90
1—LED	96c

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SPECIAL RELEASE NEW MODEL

N. S. ELECTRONICS PORTABLE CALCULATOR

Manufactured by National Semiconductors

- Adds
- Subtracts
- Multiplies
- Divides
- Two place decimal setting for addition and subtraction
- 216 battery
- Optional power supply

ONLY
$28.95
Pack and Post **90c**

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SOUND PROJECTORS
Cinevox Prefect and Harmour and Heath 16mm in good working order. 240v operated, complete with speaker and amplifier.
from $115.00

CIRCULAR SLIDE RULE
3¾in diameter. Will do the same work as the conventional slide rule. Instruction book included.
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P.M.G. TYPE TELEPHONES
Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.
$25.00
(2 TELEPHONE SETS)
Including ¼ mile twin telephone cable $1 cartage to rail. Freight payable at nearest attended railway station.

TRANSPONDER APX6
with Lighthouse Tubes. Can be converted to 1200 MHz. **$17.**

66VTVM
University Graham Tested **$45** Post $1.00

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1½ to 3 volts DC. Ideal for model boats, cars, planes, etc. Strong torque. Only
65c each or 10 for $4
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Genuine Smiths Eight Day Jewelled movement, sweep second hand and start of trip indicator. Dash mountings. Ideal for car rallys.
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"PLESSEY"
Producermatic 2" professional endless cartridge replay machines 2 track stereo with third cue track for machine control (auto-stop etc.). 600 OHM line level outputs. 240V AC operation. All silicone transistors 7½ I.P.S. 19" rack mounting. 60 Hz (240V) Model $50, 50 Hz (240V) Model $60. Ideal for tape idents, background music, etc. $1 cartage to rail. Freight payable at nearest attended railway station.

TELEPHONE WIRE
1 mile twin (2 miles) genuine ex-Army Don 8 perfect condition $35 per drum $1 cartage to rail freight payable at destination.

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Genuine ex-army Mk 3. liquid damped, as new **$27.50** P & P $1.05.

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Auto-tuned 100-150MHz. 10 channel
$65.00

HALF INCH RECORDING TAPE
Top Grade 2400' on 10½" reels. Ideal Video Experimenting. Only **$3.50**
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25 bank 25 position **$4** each.
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ADLER FREQUENCY METER
100KHz-20MHz **$95**

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50 volt DC, suit slot car. Lap counters, etc.
$1.25 each. P & P 30c.

NIBBLING TOOL
Cuts sheet metal like a punch and die, trims, notches and cuts to any size or shape over 7 16-inch.
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1.2 Volt, fully charged, 4in x 3in x 1in 4 AH.
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Frequency Meters.
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HANDY SIGNAL INJECTOR
Produces an Audio Signal in rich harmonics. Ideal for Sig Tracing in A.F., I.F., and R.F. circuits. Powered by 4 Penlight Batteries with On-Off Switch and indicator lamp. Size 1½" Diam. 5" Long. Only **$6.50** P&P 55c.

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25 x 30 **$19.95** — 40 x 40 **$28.95**
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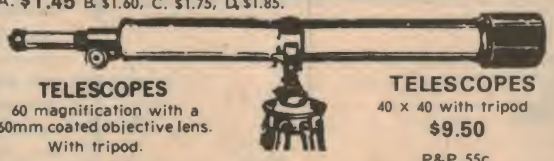

TELESCOPES
60 magnification with a 60mm coated objective lens. With tripod.
$29.50
As illustrated.
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40 x 40 with tripod
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P&P 55c.

WALKIE TALKIES
2-way radio, 7 transistor, PMG approved, set of 2 only **$47.50**
9 transistor $59.50.
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3in x 2in containing 2 valves, qty. of resistors, etc.
ONLY 75c
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ELECTRONIC FREQUENCY COUNTER
Austronic type DFC-4 240V 50 cycle 0-100KHZ **$150**

IMPELLER PUMPS
New gunmetal body, Stainless Steel Shaft. Neoprene Impeller. Up to 15ft. Lift, suitable for almost any type of liquid. Self priming. Ideal boat bilge pump, sullage drains, etc. Approx size 8" x 5".

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½"	$22.75
¾"	$27.50

P & P A. $1.45, B. $1.60, C. $1.75, D. $2.

A.W.A. B.F.O. TYPE R7077
1-800 CYCLES
1-13 K/CS. **$30.00**

CONDENSER LENS
2½in DIAM. 2in FL. $1.50 each. Or $2.50 per pair. P & P 20c.

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100-150 M/CS
$35.00

Cossor Double Beam Oscilloscope 1035. Tested
$150

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BRAND NEW
IN CARTONS

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P & P 30c.

PARABOLIC REFLECTORS PYREX MIRROR
36" dia. Ideal solar radio optical experimenting also decorating purposes. $37.50. Sorry shop sales only.

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X BAND WITH KLYSTRON ETC. **$45.00**

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Five sizes: ⅜-inch, ¾-inch, ⅞-inch, 1-inch and 1⅛-inches. With taper reamer.
$13.95
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Mk. II ..... $5.25 ea.
No. 19 TWO-WAY RADIOS.
Power supply, accessories, etc., $35.

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PRISMATIC. Coated Lenses. Brand new. Complete with case.

7 x 35 Wide Angle	$34.50
8 x 40 Wide Angle	$39.50
7 x 50	$28.65
10 x 50	$29.60
12 x 50	$30.60
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P & P A. $1.45, B. $1.60, C. $1.75, D. $1.85.

3000 TYPE RELAYS
P.M.G. 200 Ohms — 1,500 Ohm Coils. $1.25 each. P & P 30c.

TOGGLE SWITCHES
Brand new, 3 amp, 240 volt. S.P., S.T. 50c each or 10 for $4.
P & P 15c ea. or 10 for 55c.

Cintel Oscillator and Electronic Counter, type 388. **$250**

SPECIAL lucky dip valve offer, 15 new valves in cartons for only $2.95. We haven't got time to sort them, so you reap the benefit.
P & P A. 60c, B. 85c, C. $1, D. $1.10.

CONDENSER LENS
1½in diam. 1½FL. 50c each.
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MINE DETECTORS
Ex A.M.F. Complete in wooden case. Ideal for plumbers, councils for locating buried pipes, etc. Freight payable at nearest attended railway station $39.00

BATTERY CHARGERS BRAND NEW WITH METER
plugs into 240V power and gives both 6V and 12V DC output. 4 amps with hi, medium and low charges.
Dimensions, 9" x 5" x 5" $35 value only
$27.50
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EX ABC RECORDING TAPES TOP BRANDS
¼" x 2400' ON 10½" REELS
$3.95
P & P A. 60c, B. 85c, C. $1, D. $1.10.

SOLENOIDS
Plunger Type 12V 300MA. Suit electric camera control, miniature trains, radio. etc.
$2.50 P & P 20c.
200 MA 24 volt, ⅛in push movement.
$2.50 P & P 20c.

ZOOM FOCUSING MICROSCOPE
Battery and mirror illuminated 900x magnification. Complete with dissecting kit slides etc.
P & P A. $1.45, B. $1.60, C. $1.75, D. $1.85. **$25.95**

TEN CHANNELS VHF TRANSCEIVER
Types TR 1934 100-125 MHz and TR 1935 125-150 MHz. 28 volt DC operated AM single crystal locks both TX and RX on same channel complete with generator. **$25.95**

RECORDING TAPES
TOP QUALITY, BRAND NEW

		Post
3" x 150'	.75c	15
3¼" x 600'	1.75	15
5" x 900'	2.20	15
5" x 1800'	3.99	20
7" x 1200'	3.25	20
7" x 2400'	5.80	55
7" x 3600'	6.99	55

CASSETTE TAPES
C60 **99c** C90 **$1.75** C120 **$1.95**
P & P 20c.

Crystal Earphone **75c** P & P 20c

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POCKET MULTIMETER
Volts A.C. and D.C. 15 to 1000 volts (3 Scales) Current D.C. 150 M.A. Resistance 1000 K Ohms Only **$8.95** P&P 55c.

SMALL DYNAMIC MICROPHONES
On Stands Freq. Resp. 60-9500 Hz. Imp. 600-50 K Ohms. Size 1¼" x 2½" Only **$5.95** P&P 55c.

BYER 77 Mk. 1
Rack Mounting Tape Recorder ex A.B.C 7½-15 ips. Full track tested
$150

A.W.A. SIG GENERATOR
UHF 140-300 MHz $65.00

LOCK DOWN CAR AERIALS
4 section telescopic 27 inch $2.95, 37 inch $3.95, 41 inch $4.25, 45 inch $4.50. Post 55 cents.

Deitch Bros.
70 OXFORD STREET, SYDNEY 2010
SORRY, NO C.O.D.

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Position & Company 2 74

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To the Advertising Manager, ELECTRONICS Australia, Box 162, Beaconsfield 2014.

- Please insert the following advertisement in the issue
- Tick the classification required

☐ FOR SALE ☐ WANTED ☐ READER SERVICE ☐ POSITIONS

Please write in block letters with ink or ball-point pen. **Number of insertions** .....

Signed:

Residential Address

State

- I enclose P. Note / Cheque for $ being full payment for lines at $1.00 per line. (minimum 2 lines)

Index to Advertisers

People who play the waiting game have just won.

If you've been patiently waiting for something special in audio equipment, congratulations.

Because you can now choose from TEAC's newly introduced triple-header.

First, a 4-channel deck with 2-channel automatic reverse playback.

Second, a unique 4-channel Dolby* Noise Reduction Unit.

Finally, a stereo cassette deck that equally competes with reel-to-reel decks selling for much more.

TEAC's A-2340R lets you record as well as listen to the new, surrounding sounds of 4-channel. And you also have the convenience of enjoying both sides of 2-channel tapes without having to change over half-way through.

The perfect partner for this deck is our 4-channel Dolby unit. The AN-300. It eliminates tape noise and hiss that can interfere with the music.

Legally we can't call our A-450 cassette a reel-to-reel deck. But listen once and you'd find it hard to tell the difference.

We've perfected it to the point of keeping wow and flutter below 0.07%. No, that's not a misprint. We did say 0.07%.

And as if that wasn't enough, it even has a built-in Dolby System.

Those are the three sound reasons why you've just won the waiting game.

See, sometimes it really pays to wait after all.

TEAC
The sound of perfection

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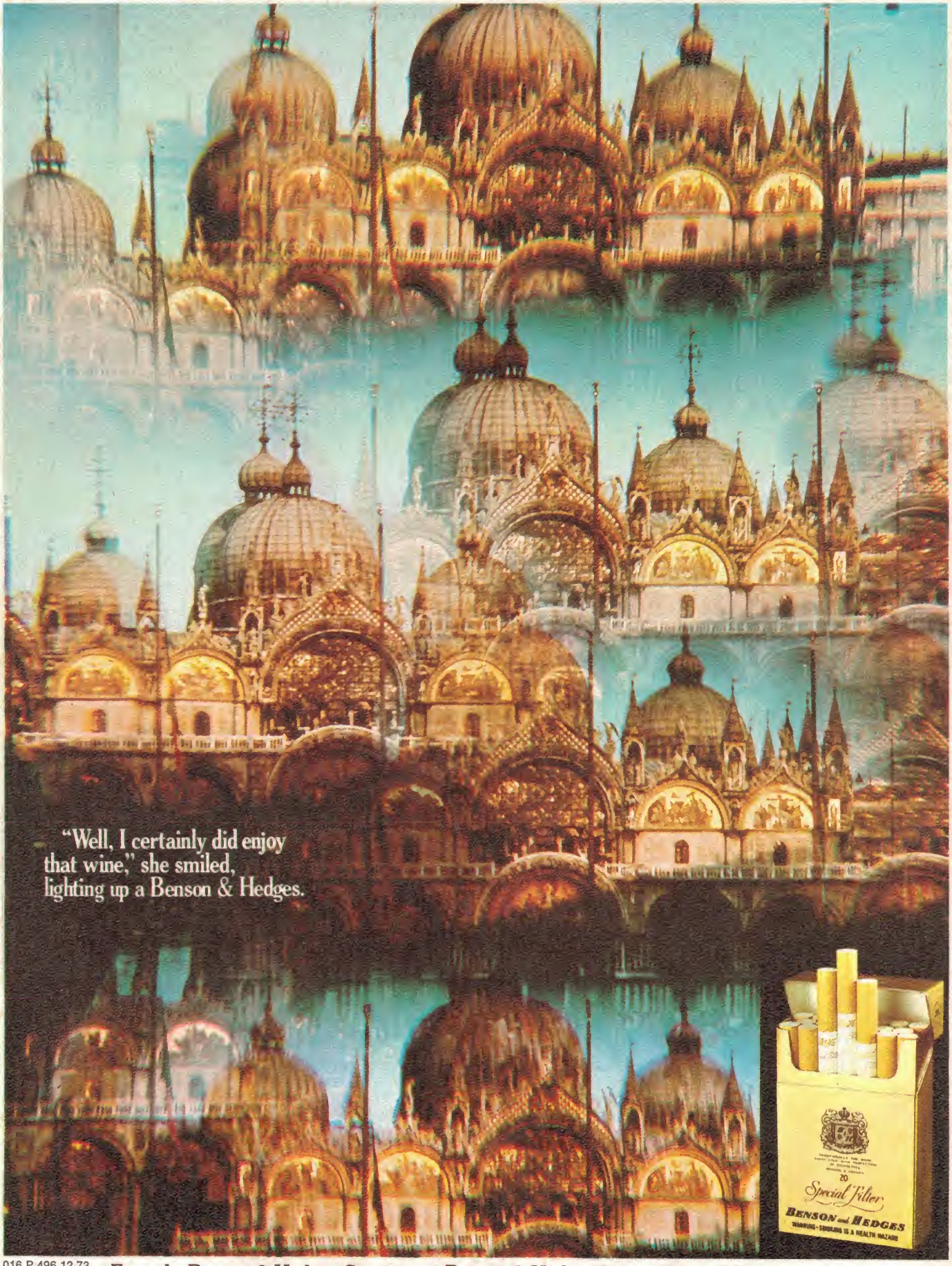

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From the Benson & Hedges Company. Benson & Hedges Special Filter. When only the best will do.